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The success of the Russian-Taiwanese Symposium “Physics and Mechanics of New Materials and Their Applications”, PMNM-2012 (Russia, 2012), 2013 International Symposium “Physics and Mechanics of New Materials and Underwater Applications”, PHENMA-2013 (Taiwan, 2013), 2014 International Symposium “Physics and Mechanics of New Materials and Underwater Applications”, PHENMA-2014 (Thailand, 2014), 2015 International Conference “Physics and Mechanics of New Materials and Their Applications”, PHENMA-2015 (Russia, 2015), 2016 International Conference “Physics and Mechanics of New Materials and Their Applications”, PHENMA-2016 (Indonesia, 2016), 2017 International Conference “Physics and Mechanics of New Materials and Their Applications”, PHENMA-2017 (India, 2017), 2018 International Conference “Physics and Mechanics of New Materials and Their Applications”, PHENMA-2018 (South Korea, 2018), 2019 International Conference “Physics and Mechanics of New Materials and Their Applications”, PHENMA-2019 (Vietnam, 2019), 2020 International Conference “Physics and Mechanics of New Materials and Their Applications”, PHENMA-2020, (Japan, 2021) and 10th Anniversary International Conference on “Physics and Mechanics of New Materials and Their Applications”, PHENMA 2021 – 2022, (Russia, 2022) predefined objectives and scientific directions of the 2023 International Conference on “Physics and Mechanics of New Materials and Their Applications” (PHENMA 2023, Surabaya, Indonesia, October 3-8, 2023). The abstracts book covers five scientific directions: processing techniques, physics, mechanics and applications of new materials, and also industry and management. The abstracts are present by scientists from 12 countries.

The book was supported financially by the Ministry of Science and Higher Education of the Russian Federation (State task in the field of scientific activity, scientific project No. FENW-2023-0012).

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PREFACE

The success of the Russian-Taiwanese Symposium "Physics and Mechanics of New Materials and Their Applications", PMNM-2012 (Russia, 2012), 2013 International Symposium "Physics and Mechanics of New Materials and Underwater Applications", PHENMA 2013 (Taiwan, 2013), 2014 International Symposium "Physics and Mechanics of New Materials and Underwater Applications", PHENMA 2014 (Thailand, 2014), 2015 International Conference "Physics and Mechanics of New Materials and Their Applications", PHENMA 2015 (Russia, 2015), 2016 International Conference "Physics and Mechanics of New Materials and Their Applications", PHENMA 2016 (Indonesia, 2016), 2017 International Conference "Physics and Mechanics of New Materials and Their Applications", PHENMA 2017 (India, 2017) and 2018 International Conference "Physics and Mechanics of New Materials and Their Applications", PHENMA 2018 (South Korea, 2018), 2019 International Conference "Physics and Mechanics of New Materials and Their Applications", PHENMA-2019 (Vietnam, 2019), 2020 International Conference "Physics and Mechanics of New Materials and Their Applications", PHENMA-2020, (Japan, 2021), 10th Anniversary International Conference on "Physics and Mechanics of New Materials and Their Applications" (PHENMA 2021 – 2022, Russia, 2022) predefined objectives and scientific directions of the 2023 International Conference on "Physics and Mechanics of New Materials and Their Applications" (PHENMA 2023), Surabaya, Indonesia, October 3-8, 2023.

A significant interest to the PHENMA-2023 has led to the great sponsor support from Ministry of Education and Science of the Russian Federation, Russia; Russian Science Foundation; South Scientific Center of the Russian Academy of Science; Ministry of Science and Technology of Taiwan; The Society of Materials Science, Kyushu Branch, Japan; Kitakyushu Convention & Visitors Association, Japan; The Korean Society for Composite Materials, South Korea; National Foundation for Science & Technology Development (Vietnam); Vietnam Union of Science and Technology Associations (VUSTA); Vietnam Association of Science Editing (VASE); New Century Education Foundation (Taiwan); Ocean & Underwater Technology Association (Taiwan); Fair Well Fishery Co. (Taiwan); Longwell Co. (Taiwan); Don State Technical University (Russia), Kyushu Institute of Technology (Japan), Korea Maritime and Ocean University; Hanoi University of Science and Technology (Vietnam); Vietnam Maritime University; Vinh Long University of Technology Education (Vietnam); Hanoi University of Industry; Vietnamese-German University (Vietnam); Ho Chi Minh City University of Agriculture and Forestry (Vietnam); Research Institute of Agriculture Machinery (Vietnam); PDPM Indian Institute of Information Technology, Design and Manufacturing (India); South Russian Regional Centre for Preparation and Implementation of International Projects, Ltd.

The following PHENMA abstracts cover five scientific directions: (i) processing techniques of new materials, (ii) physics of new materials, (iii) mechanics of new materials, (iv) applications of new materials, and (v) industry and management. These are present by scientists from 12 countries, demonstrating strong scientific collaboration, formed for last years.

Conference Chairs,

Dr. Erni Puspanantasari Putri, Prof. Ivan A. Parinov, Prof. Shun-Hsyung Chang

ABSTRACTS

Measurement and Efforts to Increase Productivity PT Biru Semesta Abadi Using OMAX (Objective Matrix) Method

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PT Biru Semesta Abadi is a company, actively trying to increase its productivity, among others, by applying the OMAX (Objective Matrix) method. From data collection and analysis, 6 productivity criteria were obtained, with a productivity index from January to December 2020 compared to 2019, namely: 118 % in January, 177 % in February, 155 % in March, 155 % in April, 117 % in May, 138 % in June, 161 % in July, 84 % in August, 132 % in September, 180 % in October, 153 % in November, and 97 % in December. After observing the causative factors, using the fishbone diagram, 15 causal factors were obtained for criterion 1; 10 for criterion 2; 16 for criterion 3; 6 for criterion 4; 10 for criterion 5; and 5 for criterion 6. By using the CTQ method, it is known that the causative factors have two largest percentage in each criterion so that 20 suggestions for improvement can be obtained to eliminate the occurrence of productivity problems at the plant C of PT Biru Semesta Abadi.

Segunung Hamlet Potential Innovation Traditional Village, Tourism and Economy Local Community

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The concept of sustainable development is simple development approach to achieve a better standard of living for the present and the future. Indonesia, as the second mega-biodiversity country in the world, is known to have very high natural wealth, flora and fauna. It is no wonder that a region in Indonesia will be competing to create an innovation to develop and cultivate a region so that it has the potential to provide benefits to others. It is necessary to develop

innovations, because existing situations and conditions are always changing in various aspects. Therefore, the potential that already exists must also be accompanied by innovation so that the existing potential can be utilized to the fullest and have an impact on the local community in the Segunung Traditional Village, which has a variety of natural and traditional tourist destinations and precisely located in Segunung Hamlet, Carangwulung Village, Wonosalam District, Jombang Regency, East Java. It is used the method of developing tourism potential productivity, which aims at village development in order to improve the welfare of village communities and the quality of life of village communities. This potential innovation is expected to provide many benefits, both for village officials and local village communities. Innovation, both in terms of location and good management, can ignite the local community to play a role in the tourism development process, maintain environmental sustainability, and improve the crafts needed to create a community with a guaranteed level of welfare.

Dielectric Properties of xSmFeO$_3$ – (1 – x)NaNbO$_3$ Composites

Abeer Alshoekh[1]*, Bashir Abdulvakhidov[2], Zhengyou Li[1], Sadyk Sadykov[2], Kamaludin Abdulvakhidov[1], Pavel Plyaka[1], Ivan Dmitrenko[1]

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Interest in the study of composite materials is based on the fact that their properties as a whole differ from the properties of individual components, and the parameters of these properties far exceed the parameters of the properties of individual components. In this work, for the first time, we have obtained composites that are ferrite-antiferroelectric xSmFeO$_3$ – (1 – x)NaNbO$_3$, where x is the ratio of components in the composition, and we also present the results of studying the dielectric properties of the 0.5SmFeO$_3$ – 0.5NaNbO$_3$ composite. The permittivity ε' of the 0.5SmFeO$_3$ – 0.5NaNbO$_3$ composite increases sharply in the temperature range from (–150 °C) to 0 °C. Above this temperature, ε' grows smoothly, reaching a local maximum at a temperature of 300 °C. The first anomaly of the dielectric permittivity ε' of 0.5SmFeO$_3$ – 0.5NaNbO$_3$ is explained by thermally activated dielectric relaxation with an activation energy of 0.34 eV.

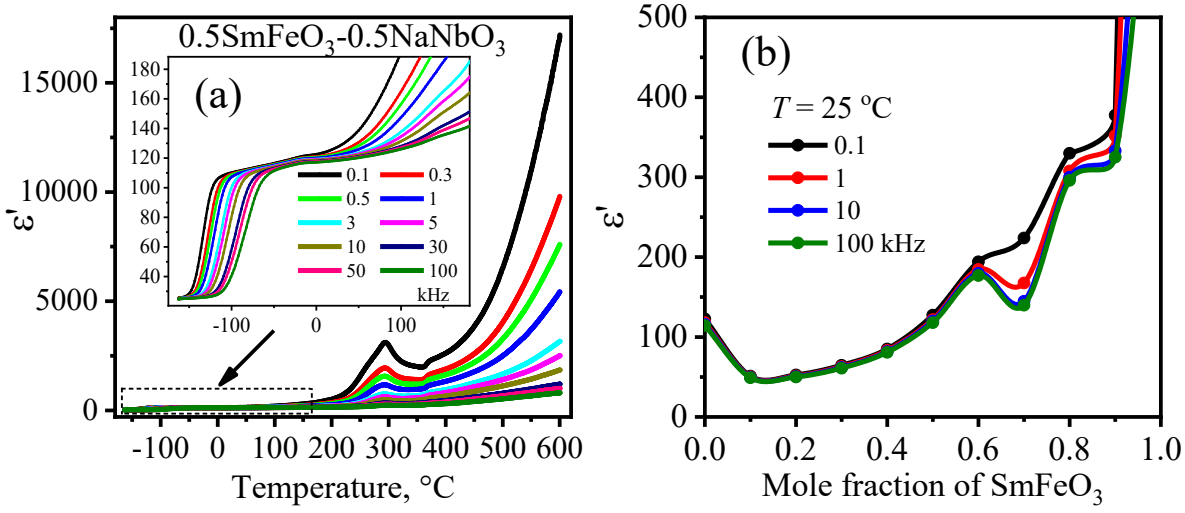

Fig. 1. Temperature-dependent dielectric constant ε' (a), doping concentration dependent dielectric constant of SmFeO$_3$ at room temperature (b).

This indicates that the dielectric behavior of the composite is affected by thermal activation processes leading to an increase in the permittivity [1]. The wide jump in dielectric permittivity around 300 °C, observed in Fig. 1(a), was previously reported by C.-Y. Kuo et al. [2], who point out the temperature-dependent dielectric behavior of this composite and explain that magnetoelastic coupling could induce strain at T_N, which would then be responsible for an artificial observation of a pyrocurrent in *b*-direction at T_N. It was found that, at room temperature, the permittivity of xSmFeO$_3$ – (1 – x)NaNbO$_3$ generally increases with an increase in the SmFeO$_3$ concentration in the composites (see Fig. 1(b)). This is due to an increase in the concentration of the more conductive phase (SmFeO$_3$) compared to NaNbO$_3$.

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Synthesis and Physical Properties of xSmFeO$_3$ – (1 – x)NaNbO$_3$ Composites

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The interest in xSmFeO$_3$ – (1 – x)NaNbO$_3$ composites likely stems from the fact that they can exhibit unique properties that are not present in the individual materials. For example, the combination of SmFeO$_3$ and NaNbO$_3$ can result in a material with improved magnetic and ferroelectric properties, which could have potential applications in data storage, spintronics, and other electronic devices. In this study, we investigate the physical properties of the xSmFeO$_3$ – (1 – x) NaNbO$_3$ composite material. The composite was synthesized using a solid-state reaction method and its crystal structure, microstructure, magnetic and electrical properties were characterized, using X-ray diffraction (XRD), scanning electron microscopy (SEM), vibrating sample magnetometry (VSM), and impedance spectroscopy techniques. Our results show that the composite material is a complex mixture of multiple phases with an average particle size of ~100 nm.

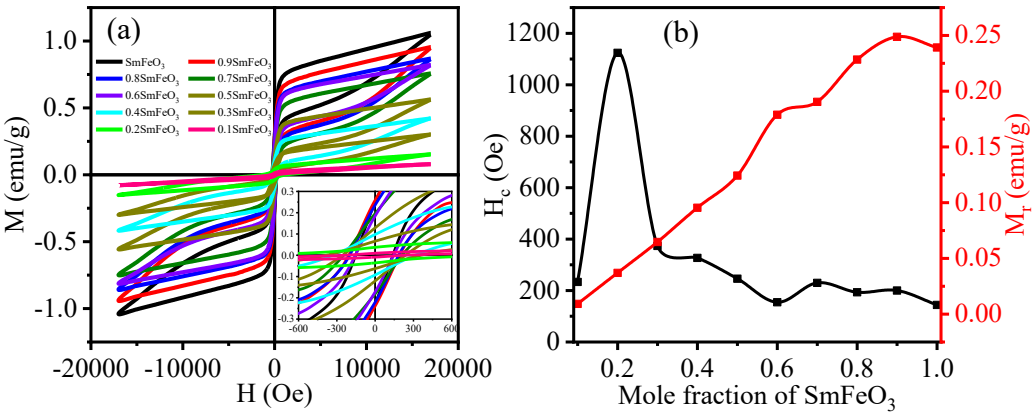

Fig. 1. Dependencies of magnetic hysteresis loops (a), coercive field H_c and remanent magnetization M_r (b) on the mole fraction of SmFeO$_3$.

The remanent magnetization of the composite increases with an increase in SmFeO$_3$ content, reaching a maximum of 0.25 emu/g at x = 0.9. The magnetic hysteresis loops of all the concentrations of the composites are shown in Fig. 1(a). As shown in Fig. 1(b), two anomalies of remanent magnetization were observed at x = 0.6 and x = 0.9, whereas for the coercivity force a

significant anomaly can be noticed at x = 0.2. This means that the amount of magnetic field, required to demagnetize the material is large, and this is caused by some factors such as crystal orientation, and the presence of impurities (the ions from $NaNbO_3$). The electrical conductivity of the composite also increases with an increase in $SmFeO_3$ content, with a maximum value at x = 0.9. The dielectric constant of the composite exhibits a peak at around x = 0.6, while the dielectric loss tangent increases monotonically with increasing $SmFeO_3$ content. Our findings suggest that the $x SmFeO_3 – (1 – x)NaNbO_3$ composite material has potential applications in magnetic and electrical devices, particularly for those requiring tunable magnetic and electrical properties.

Aspect Ratio Optimization of Piezoceramic Piezoelements for Maximizing Energy Conversion in Energy Harvesting Applications

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Piezoelectric materials are widely used in many applications, including medical diagnostic transducers, NDE, sensors and actuators. At last decades, a wide variety of devices, based on piezoceramic elements, vibrating in longitudinal, lateral or flexural mode, were developed for energy harvesting applications. A variety of performance metrics have been used to compare piezoelectric materials on diverse applications. Among them, energy conversion efficiency is the most important one when designing piezoelectric energy harvesters for real applications. Various figures of merits (FOMs) have been proposed for evaluating the energy conversion efficiency of piezoelectric materials:
(i) coupling factor, which is the ratio of stored electrical energy to input mechanical energy ($k^2 = d^2E/\varepsilon$);
(ii) product of two piezoelectric constants, which measures the stored electrical energy when the piezoelectric materials are at the same stress ($dg = d^2/\varepsilon$);
(iii) efficiency of piezoelectric element in an energy harvester, when the passive elastic layer is much thicker than piezoelectric layer of a linear cantilever structure (e^2/ε);
(iv) dimensionless FOM, that is a product of two FOM's representing on-resonance ($k_{31}^2 Q_M/S_{11}^E$) and off-resonance ($d_{31}g_{31}/\tan\delta$) conditions [1].
All above listed piezoelectric (d, g, e), electromechanical (k), elastic (E) and dielectric (ε, $\tan\delta$) coefficients of piezoceramics are strongly dependent on shape and dimensions of piezoceramic elements. Correct choice and optimization of the aspect ratio of piezoceramic elements maximizes energy conversion efficiency in energy harvesting applications. In this work, the dependences of complex parameters of rectangle-shaped piezoceramic elements on the aspect ratio, i.e., the ratio of length (W_2) to width (W_1) were studied and analyzed. Dense and porous piezoelectric ceramics of the PZT type with the composition $Pb_{0.95}Sr_{0.05}Ti_{0.47}Zr_{0.53}O_3$ + 1% Nb_2O_5 and relative porosity up to 40 % were obtained by conventional sintering and modified method of pore former burning-out. Rectangle-shaped samples with the aspect ratio $G = W_2/W_1$ in the range from 1 up to 6 and equal thickness were prepared and studied. Dependences of complex piezoelectric (d_{31}), electromechanical (k_{31}), elastic (S_{11}^E) and dielectric (ε_{33}^T) coefficients on the aspect ratio $G = W_2/W_1$ were measured and analyzed on the longitudinal vibration mode of rectangular piezoelements using an impedance analyzer Agilent 4294A and the piezoelectric resonance analysis program (PRAP). It was found that the dependences of the complex electromechanical parameters of dense rectangle-shaped piezoceramic elements on the aspect ratio G have a strongly

oscillating character in the range of G values from 1 to 2. In its turn, porous piezoceramic elements demonstrate smoother and less pronounced dependencies on the aspect ratio due to the inherent anisotropy of the electromechanical parameters of porous piezoceramics. The obtained dependences are non-linear and allow choosing the optimal aspect ratio values for each measured parameter and, accordingly, for each figure of merits for maximum energy conversion efficiency in energy harvesting applications.

Acknowledgements. The work was financially supported by the Ministry of Science and Higher Education of the Russian Federation (State assignment in the field of scientific activity, Southern Federal University, 2023, Project No. FENW-2023-0010/(GZ0110/23-11-IF)).

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Aspect Ratio Dependence of Complex Electromechanical Parameters of Dense and Porous Piezoceramic Elements

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Piezoelectric materials are widely used in many applications, including medical and NDE ultrasonic transducers, sensors and energy harvesters. A wide variety of devices, based on piezoceramic elements, vibrating at different frequencies in longitudinal, lateral or flexural mode, were developed for piezoelectric and ultrasonic applications. The evaluation of the capability of converting mechanical energy into electric energy and *vice versa* is a main issue in the device design. The most important parameter characterizing a piezoelectric material is the electromechanical coupling coefficient, which specifies the conversion efficiency between electrical and mechanical energies for a given vibration mode. Elastic, piezoelectric and dielectric constant are also important for estimation of energy conversion efficiency in energy harvesting and ultrasonic transducer applications. In most applications, dense piezoceramic materials of PZT type are typically used, for which the aspect ratio is a critical factor, limiting the frequency range and devices efficiency. Therefore, of considerable interest is the study of anisotropic composite materials for which the aspect ratio is not so critical. In this work, an analysis of complex dielectric, electromechanical and elastic parameters of rectangle-shaped porous piezoceramic elements with different ratios between length and width at fixed thickness is performed in order to establish the optimum aspect ratio for optimization the efficiency of thickness mode resonators [1]. PZT type dense and porous piezoelectric ceramics of the composition $Pb_{0.95}Sr_{0.05}Ti_{0.47}Zr_{0.53}O_3$ + 1% Nb_2O_5 with relative porosity from 0 up to 40% and average pore size of 10 – 30 μm were chosen as the object of the study. Rectangle-shaped dense and porous piezoceramic samples with the aspect ratios $G = W_2/W_1$ in the range from 1 up to 6 and of the same thickness were fabricated and studied. Dependences of real and imaginary parts of piezoelectric (e_{33}), electromechanical (k_t), elastic (C_{33}^D, C_{33}^E) and dielectric (ε_{33}^S) coefficients on the aspect ratio $G = W_2/W_1$ were measured on the thickness vibration mode of porous and dense experimental samples using an impedance analyzer Agilent 4294A and the piezoelectric resonance analysis program (PRAP). Frequency dependences of complex parameters in the frequency range up to 40 MHz were measured using PRAP analysis of high-order resonances of thickness mode oscillations of rectangle shaped piezoceramic elements with different aspect ratios. It was found that the dependences of the complex

electromechanical parameters of porous piezoceramic elements on the aspect ratio *G* have a much less pronounced and oscillating character then for dense PZT type piezoceramics in all range of *G* values from 1 to 6 due to the inherent anisotropy of the electromechanical parameters of porous piezoceramics. The obtained dependences allow to choose the optimal aspect ratio values for each measured parameter and, accordingly, to maximize efficiency and frequency range of piezoelectric and ultrasonic transducers.

Acknowledgement. The study was financially supported by the Russian Science Foundation, grant No. 22-11-00302, https://rscf.ru/project/22-11-00302/ at the Southern Federal University.

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Productivity Analysis Using the OMAX Method

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A company organization, engaged in manufacturing named PT. Vega Jaya, which manufactures lamps, needs to know the level of productivity, in which the company operates, as a comparison with the productivity standards set by management. Estimation of productivity by using the OMAX method, includes several features that have been weighted according to the degree of importance of each measure. The results of calculating the overall productivity value for 15 (fifteen) months are as follows: 2.95, 9.14, 6.54, 7.29, 8.45, 1.32, 8.27, 8.01, 1, 73, 5.42, 4.50, 7.96, 9.89, 0.84, 1.33. The results of calculating the value of work temptation do not contribute enough to increasing the productivity of the production line and need attention because it shows performance that is below standard, namely months 1, 6 and 9. Meanwhile, the value of work harassment in months 2, 5, 7 and 13 shows the value of work tend to be good. Based on the results of this study, measuring productivity with the OMAX method is very systematic and effective, because it is built from critical factors in the company (productivity criteria) by prioritizing improvements to ratio values that have values below standard, and maintaining good ratio values.

Design of a Roll Welding Turntable as a Welding Tool (Case Study: Art Welding Pt. Meco Inoxprima)

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Welding produces a quality connection and is very often used to connect metallic parts of various shapes and positions. Therefore, the welding process must require a practical material supporting device in accordance with the needs of all welding positions, which will facilitate and provide welder comfort in welding. So the results of maximum and quality welds (good visually) are presented in this study of the type of connection used. It is angular joint with the aim of designing and making tools for welding joints and comparing the distortions that occur between using desk

tools rotate and without using tools. In this study Gtaw welding was used with the brand DC ARC WELDER with type Bz-300F-3 and filler type ER 308L, voltage of 20 – 30 V, travel speed 60 mm/min and variations of current (A), namely 100 A, 125 A and 150 A, with a diameter of 2.4 mm as a filler. The study was limited to the design and manufacture of tools and measurements of distortions carried out 20 times. Distortion measurement uses a dial indicator with a starting point / zero point on the end of the test object and the end point in the weld joint area. The results show that the use of roll welding tools can reduce the occurrence of distortion. The smallest value of distortion is obtained by using a roll welding rotary table tool, which is equal to 0.33°, while the smallest value of distortion without using roll welding is 1.33°. The use of roll welding rotary table aids can reduce welding defects, reduce setup time and can increase production volume that results to a decrease in production costs, making it quite feasible and efficient in terms of the economy.

Analysis of the Productivity Index (PI) Calculation Using the Mundel Approach in the Food and Beverage Company PT. Sinergitas Indonesia Muda

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PT. Sinergitas Indonesia Muda, a F&B company, that includes the Suweger Indonesia beverage brand, specializes in modern dairy, tea, and chocolate goods. The business, which has its headquarters in Surabaya, opened its first location in Keputih, Surabaya, in 2019 and uses a close bar system. The corporate culture places a strong emphasis on customer focus, operational performance, and a positive outlook. This study intends to examine how PT. Sinergitas Indonesia Muda calculates the Productivity Index (PI) using the Mundel technique. The business has currently successfully opened 29 locations in Surabaya and Sidoarjo. The calculation of the Productivity Index (PI) takes into account various factors, including labor, labor costs, capital depreciation, book value of capital, direct total costs, overall total costs, energy consumption, materials, investment, transportation costs, and machine maintenance costs. The Mundel method is used to measure the productivity of a company by considering relevant inputs and outputs in its operations. The analysis is conducted on data, collected from a specific period, to comprehensively calculate the Productivity Index (PI). By using this approach, PT. Sinergitas Indonesia Muda can identify operational efficiencies and performance and accurately measure its level of productivity. The results of the analysis show variations in the company's productivity levels during the study period. By utilizing the Productivity Index (PI), PT. Sinergitas Indonesia Muda can identify areas that require improvement and take the necessary steps to enhance operational efficiency and performance. These findings provide a foundation for the company to make strategic decisions, related to productivity improvement and competitiveness. This research contributes to the understanding of the importance of measuring productivity in the F&B industry, particularly in companies that encompass contemporary beverage brands like Suweger Indonesia. By implementing the Mundel approach, companies can effectively monitor and improve their productivity. Further studies can be conducted to analyze factors that contribute to productivity variations and identify more specific strategies to enhance productivity in F&B companies.

Productivity Analysis of PT. Tjakrindo Mas Gresik Using OMAX Method: Criterion Mapping and Weight Determination for Operational Efficiency Enhancement

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PT. Tjakrindo Mas is an experienced manufacturing company that specializes in producing various office equipment, electrical panels, infrastructure products, PVC pipes, concrete products, and wooden furniture. In this analysis, the inputs considered are Raw Material Units, Labor Units, Machinery Units, Energy (kW·h), and Units Produced (pieces). The analysis covers the period from January 2022 to June 2023, spanning a total of 18 months. The objective of this analysis is to measure the productivity index of PT. Tjakrindo Mas, using the OMAX method, which has been further developed. The OMAX method serves as a framework to map relevant criteria, determine the weights of the criteria, and analyze the company's productivity. The processed data reveals a productivity achievement graph that reflects the company's performance. Additionally, the Total Productivity Index (total IP) is calculated. The results of the data processing indicate total IP values of 0.45, 0.08, 0.43, –0.10, 0.54, 0.02, 0.06, and 1.03, providing insights into the company's productivity levels during the analysis period. This analysis aims to provide insights into the productivity of PT. Tjakrindo Mas and lays the foundation for identifying areas that require improvement in order to enhance overall efficiency and company performance. The developed OMAX method can serve as a useful tool in making strategic decisions and optimizing the company's productivity.

Analysis Productivity: Productivity Measurement with the OMAX Method

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The main motivation of this research is to see the level of productivity in prol tape production division of UD. Purnama Jati in order to increase the prol tape productivity with the Objective Matrix (OMAX) method. The research also was performed by evaluating the worst performance ratio with the Traffic Light System. The result showed that the measurement period in June 2019 with a productivity index value of 118% had the highest productivity index value. Meanwhile, the lowest productivity occurred in the period of July 2019 with a productivity index of (−47.89 %). Based on the evaluation results of utilizing the Traffic Light System technique, the ratio at the level of "CRITICAL" was a ratio of 1 that is the ratio of productivity of raw materials. UD. Purnama Jati requires to focus on the variables that cause a decline in productivity and can be improved according to the proposed improvements.

Illuminating the Future: Innovation in Making Simple Study Lamps Using Inventor

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As we know, learning lamps function to provide maximum lighting so that to increase focus and concentration to support the learning process. Therefore, in designing and modeling this study lamp, accuracy is required for each component. One of the supporting software features for making manufacturing products, including effective and efficient study lamps, is Autodesk Inventor. Autodesk Inventor is a 3D design software, developed by Autodesk. Autodesk Inventor is designed to support product design, documentation, and stimulation in engineering and manufacturing. This software is often used by engineers, designers, and professionals in various industries to design complex products and systems. Autodesk Inventor software enables users to precisely design 3D learning lamps and other manufactured products. Using the available modeling tools, the user can create the geometry of the object, including the desired shape and size. Designers can use the software to design and integrate components with assembly features. Designers can choose the right components and ensure they fit. In addition, Inventor also offers the possibility of creating realistically designed visualizations of learning lamps and other manufactured products. Designers can apply textures, materials, colors, and other visualizations to create realistic looks. So it can be concluded that the Autodesk Inventor software is a 3D design software that offers capabilities that can be used to design engineering drawings. This software enables precision modeling and excellent design of learning lamps or other manufactured products. Designers can also use existing features to integrate components effectively. In addition, designers can create realistic visualizations so that they can visualize exactly what a study lamp or other manufactured product will look like, starting with materials, colors, textures, and other components. Thus, they can imagine how the original product will look, if it is produced later. Overall, Autodesk offers technical designers the convenience to make their designs effective and efficient.

Development of Innovative Clothesline Design Using Autodesk Inventor for Indoor

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As many people already know, clotheslines serve as a place to hang or shake clothes. It has become an obligation that every home must have a feather. Especially in the size that is used in the home. In addition to being able to facilitate the process of moving from one place to another, the shovel's size, which is not too large, also does not take up a lot of space. This is what is taken into consideration in designing the model of jamming. So in the design process itself, it is also necessary to use supporting software to design so that the product is produced in accordance with the plan. The software is called Autodesk Inventor. Autodesk Inventor is one of the Autodesk Corp. software products used for engineering design and drawing purposes. Autodesk Inventor has several advantages, such as design and editing capabilities in the form of solid models, the

ability to animate file assembly, the ability to automatically create technical 2D drawings, and the materials provided that give a more realistic appearance to a part. Thus, in the design process, the manufacturing process is easier and can minimize size errors in the manufacture of products.

House of Hadji Oemar Said Tjokroaminoto

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The residence of H. O. S. Tjokroaminoto was inaugurated on 27 November 2017 as a museum for the Surabaya City Government as well as a historical tourist destination by the Mayor of Surabaya, Tri Rismaharini. Located on Jalan Peneleh Gang VII Surabaya, the house is not only used by National Hero H.O. S. Tjokroaminoto and his family as a place to live, but also as a place, where movement figures from various ideological backgrounds such as Semaoen, Alimin, Darsono, and Tan Malaka met and dialogue. The H.O.S Tjokroaminoto Museum has 143 collections, related to the residence of H.O.S Tjokroaminoto. This research was conductes on 17 June, 2023 and used the survey method. To look directly the things that are the problem the museum is indeed to be located in the middle of the city. However, side by side with residents, the access to this museum is quite astonishing because it locates into a narrow alley and there is also no adequate parking space for a historical and cultural museum level. When viewed from the maintenance perspective of the museum itself very well maintained. Even the relics still look good and there are no defects for the building itself which still stands firmly for tens of years left by the owner through colonial times and ended in a transitional period to the present. It could be said the museum area H.O.S Tjokroaminoto is included in an area that has historical and cultural values, but again and again these buildings are being transferred to trade places for irresponsible elements.

Structural Scheme of an Electromagnetoelastic Actuator for Nanotechnology Research

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An electromagnetoelastic actuator is electromagnetomechanical device intended for actuation of mechanisms, systems or management, based on the piezoelectric, piezomagnetic, electrostriction, magnetostriction effect, converts electric or magnetic signals into mechanical movement and force [1 − 4]. The piezoactuator is used in vibration compensation and absorption systems in aircraft and rotorcraft elements, in nanotechnology research for scanning microscopy [5]. The structural scheme of the electromagnetoelastic actuator for nanotechnology research is constructed by using the equation of electromagnetoelasticity and the linear ordinary second-order differential equation of the actuator. An electromagnetoelastic actuator is used in nanotechnology, microelectronics, nanobiology, astronomy, nanophysics for the alignment, the reparation of the gravitation and temperature deformations [9 − 30]. The nanomanipulator with the piezoactuator is applied in the

matching systems in nanotechnology. In the present work, the problem of building the structural scheme of the electromagnetoelastic actuator is solving in difference from the electrical equivalent circuit [6 − 8]. The transformation of the structural scheme under various boundary conditions of the actuator is considered. The matrix transfer function is calculated from the set of equations for the structural scheme of the electromagnetoelastic actuator in control system. This matrix transfer function for the deformation of the actuator is used in nanotechnology research.

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The Potential of 3D-Based Manufacturing Technology Using AutoCAD Application for Product Innovation

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Product innovation has been successful key and competitive advantage in various industrial sectors. In recent years, 3D-based manufacturing technology using AutoCAD applications has been one of the main boosters for increasing product innovation [1, 2]. The rapid development of technology has resulted in progress in many aspects, especially in the availability of engineering drawing software that supports building design activity. The method used is literature and a comprehensive analysis of relevant information. Research results show that 3D-based manufacturing technology uses the AutoCAD application as a design tool and provides many benefits for increasing product innovation. This technology allows designers and people who want to learn about engineering drawing to quickly prototype, reducing time, and costs incurred in the product development process. AutoCAD can speed up image production because of its greater design flexibility and its good features. The features can be easily used by designers, especially the zoom feature, which clarifies image details from any angle. Therefore, exploitation of 3D-based manufacturing technology using AutoCAD applications can bring significant increases in product innovation by creating an innovative and unique design. The company can create more efficient products with personalization and high quality so that it can improve customer satisfaction and competitiveness in the market.

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Implementation of Transportation Methods on Efficiency of Wood Pallet Company Shipping

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The transportation method is a method used to regulate distribution from sources that provide products to places that need for them optimally at the lowest cost. Distribution plays a role for the company because the company's profits depend on it. One solution to the distribution of goods is to use the transportation method, where the distribution is carried out as effectively as possible with the minimum possible allocation of costs. The purpose of this research is to obtain more

optimal results as an initial consideration for increasing distribution cost savings in wood pallet companies. The data is then formulated using LINGO software, and the result is IDR 87,200,000.

Optimization of Celurite Production Using Goal Programming

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Goal programming is a decision-making technique, that is a special variation of linear programming, that can solve multi-objectives by minimizing the deviation from the goals set by the decision maker. This method aims to minimize the costs. In this research, we visited the Pande Besi SMEs that process iron into sickles and iron bending products. Blacksmith's decision-making is still based on incoming consumer demand, so the production process is still not optimal. Therefore, this study aims to apply the goal programming model to making production plans that maximize the existing resources of the company so as to obtain maximum profits. This method is used to optimize limited resources with multiple targets (multi-objectives), that the Pande Besi company wants to achieve. Optimal results are obtained with the Lingo software. The goal programming model has three main components: decision variables, target constraints and objective functions. The results of calculations using Lingo show that blacksmiths can get an optimal income of Rp. 250,000 with a product capacity of 15 units of iron bends and 12 units of celurite.

Achievement of Performance Against Targets Using the OMAX Method

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This study aims to analyse the application of the OMAX method to improving the productivity of a cigarette factory. The OMAX method is used to identify and reduce productivity losses that occur in the factory. This study involves the following steps. First, the identification of key factors that influence the productivity of the cigarette factory, such as machine downtime, product changeover time, and product defects is performed. Next, the measurement of overall equipment effectiveness (OEE) is conducted to assess the effectiveness of the factory's production equipment. After the OEE measurement is performed, the main causes of productivity losses are identified. For example, there may be excessive machine downtime due to maintenance issues or equipment failures. Additionally, there may be issues with product changeovers that affect production efficiency. Subsequently, appropriate improvements are implemented to address these issues. Monitoring and evaluation are carried out to track the effectiveness of the implemented improvements. OEE measurement and other key factors are continuously monitored to measure changes in the productivity of the cigarette factory. The results of this evaluation help to identify the success of the improvements and determine any additional steps that need to be made. This study provides insights into the application of the OMAX method in a cigarette factory and can be

beneficial in enhancing the productivity and efficiency of the factory. This method assists the cigarette factory in effectively identifying and addressing productivity losses, thereby improving the overall performance of the factory and optimizing cigarette production.

Method of Measuring the Cost of Production as Input with the Marvin Mundel Method

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Cigarette productivity is a key factor in the tobacco industry, as it directly impacts production efficiency and profitability. This study aims to analyze and evaluate the productivity of cigarette manufacturing processes, focusing on factors that influence productivity and strategies for improvement. The research methodology involves data collection from cigarette manufacturing companies, including production output, labor input, machinery utilization, and production costs. Productivity indicators such as output per worker, output per machine, and cost-effectiveness are calculated and analyzed. The findings reveal the importance of efficient production processes, optimized resource allocation, and effective management practices in enhancing cigarette productivity. Factors such as technology utilization, workforce training, supply chain management, and quality control play crucial roles in improving productivity. Furthermore, the study explores potential strategies for enhancing cigarette productivity, including the adoption of advanced machinery and automation, process optimization, lean manufacturing principles, and continuous improvement initiatives. By understanding and improving cigarette productivity, tobacco companies can enhance their competitiveness, reduce costs, and meet the growing demand for cigarettes in a sustainable manner. However, it is important to consider the potential health and environmental implications of increased cigarette production and consumption. This study contributes to the understanding of cigarette productivity and provides insights for industry practitioners and policymakers to optimize production processes, increase efficiency, and achieve sustainable growth in the tobacco industry.

Approximated Analytical Solution for Nanoindentation Experiment Analysis of Coated Solids

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Modification of the initial surface details of substrates by various coatings depositions allows one to expand the scope of their application. For practical research of the mechanical characteristics of coatings nanoindentation technique is frequently used. In the present research, indentation process of an elastic half-space with a coating is considered. Using Hankel integral transformation the problem is reduced to solution of a dual integral equation [1]. Special approximation for the kernel transforms of the integral equation is used. Approximated analytical solution of the integral equation is obtained in two forms. First one is obtained using the most accurate approximation

with relative error not exceeding 0.3 % for most combinations of coating and substrate properties [2]. The second form of solution is obtained in a simplified form using the simplest possible one-parametric approximation of the kernel transform. It makes it possible to obtain distribution of the contact stresses, indentation depth, indentation stiffness and indentation force in simple analytical forms convenient for engineering applications [3]. Ranges of values of elastic and geometrical parameters are obtained, for which the presence of a coating sufficiently changes the contact characteristics. The accuracy of the obtained simplified expressions is studied in detail. Results of the paper sufficiently simplify engineering calculations and are suitable for inverse analysis, for example, analysis of indentation experiments of coated materials using either a conical or a pyramidal (Berkovich) indenter.

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Application of the Analytical Hierarchy Method Menu Priority Determination Process (AHP), which was Developed in School Canteen X

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The AHP method is used as a framework in this study. First, the decision maker identifies the main goal, which is successful menu development. Furthermore, this goal is translated into more specific criteria, including popularity, profitability, conformity with the restaurant concept, and availability of raw materials. This study uses examples from the food and beverage industry to illustrate the application of the AHP method. Data, obtained from consumer surveys and financial analysis, are used in this study to obtain relative preferences and relative weights. The results of the study show that the AHP method can provide clear guidance in determining menu priorities to be developed. In this case example, the menus that score the highest priority are those that are considered to have high popularity and good profitability potential. In conclusion, this study shows that the AHP method can be used effectively in determining menu priorities to be developed in the food and beverage industry. By considering various relevant criteria, this method helps decision makers to make more informed and rational decisions in developing the most optimal menu to achieve the desired business goals.

Productivity Analysis of Marvin E. Mundel and Lean Manufacturing Applications (Case Study of PT. Abadi Water)

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PT. Abadi Water Pandaan Pasuruan, East Java, is a company engaged in the beverage industry in the form of ready-to-drink osmosis water in bottles. The current condition of the company is experiencing fluctuations in productivity issues, while in production there is also a situation where there is a lot of waste in the production process resulting in non-optimal production results. This research aims to increase the level of productivity and minimize waste on the base of the Marvin E. Mundel Method and Lean Manufacturing. These two methods are the most appropriate methods in solving this problem because they are related to optimizing the production process. This study produces a productivity index on 5 inputs, namely labour, energy consumption, depreciation, materials and maintenance. From data processing, the lowest input index was obtained by June 2020, namely 83.49 % and the highest – by July 2020, namely 126.93 %. To reduce waste, 3 tools were selected, namely PAM, SCRM and QFM. With PAM it can increase PCE by 4.29 % for SCRM using the MPS method and for QFM in machine maintenance and also training for employees.

Coffee Bean Processing Analysis Using Objective Matrix (OMAX) Method (Case Study: Pt. Aneka Coffee Industry)

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PT. Aneka Coffee Industry is a coffee company that produces and sells various types of coffee products. This study aims to analyze the company's business strategy using the Objective Matrix (OMAX) method. The OMAX method is used to identify the company's strengths, weaknesses, opportunities, and threats (SWOTs) and to determine the company's strategic priorities. The results of the analysis show that PT. Aneka Coffee Industry has several strengths, such as a strong brand image and a wide range of products. However, the company also has weaknesses, such as limited distribution channels and a lack of innovation. In terms of opportunities, the company can expand its market share by targeting new customer segments and developing new products. The threats, faced by the company, include intense competition and changes in consumer preferences. Based on the analysis, the company's strategic priorities are to improve its distribution channels, increase its focus on innovation, and expand its product portfolio. Overall, the OMAX method provides a useful framework for analyzing the company's business strategy and identifying areas for improvement.

Finite Element Calculation of Stamp Insertion into a Poroelastic Water-saturated Medium

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To develop eye prostheses and prevent diseases, studying the mechanical characteristics of the cornea is essential. However, direct measurement of the cornea's mechanical properties is not possible during ophthalmological study. Data can only be obtained experimentally on an enucleated eyeball, which changes the true values of the characteristics. Cornea's heterogeneity and different tissue thickness make an accurate analysis of tissue state impossible. As an alternative, finite element method analytical and numerical models of the cornea are being developed as an experimental substitute. The study, proposed in this report, is aimed at studying the stress-strain state of the cornea, taking into account intraocular pressure in the contact zone, when using a flat indenter. The report considers the axisymmetric problem of indentation a planar indenter in a multilayer sample with poroelastic properties. Friction in the contact area is neglected. The problem is solved in a non-stationary formulation, the force, applied to the indenter, depends on time. This dependence has several characteristic sections that correspond to loading and unloading. The first section corresponds to a linear increase in force, followed by a section where the pressure force is constant and followed by unloading, in which the force decreases according to a bilinear law. The solution is carried out numerically in the finite element packages ANSYS and FlexPDE. The problem is solved in the FlexPDE package for layered and homogeneous poroelastic materials. Where the layered material is represented by four layers with different Young's moduli and Poisson's ratio and models the cornea of the eye, and the homogeneous material is a water-soaked sponge. Displacements and stresses along the *Y*-axis are obtained, as well as the distribution of pore pressure. Next, the problem is considered in the ANSYS package for materials with similar characteristics. Equivalent stresses for the given forces, equivalent elastic deformation and equivalent von Mises stress are obtained.

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Case Study of Calculation of Productivity Index (PI) Using the Mundel Approach at PT Kosmetika Global Indonesia

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PT Kosmetika Global Indonesia is a manufacturing company established in 2018, which is engaged in cosmetics, skin care and body care. It was formed and developed by experienced experts and supported by young employees, who have unlimited passion and totality. KOSME continues to develop and grow with quality reliable products and is supported by premium services for its customers. KOSME has complied with the production standard requirements and has gone through the production feasibility test from BPOM and has international equivalent Standard Operating Procedures in the production process, packaging up to storage of production results. In an era on the verge of an industrial recession, as it is today, it causes many problems that occur in companies, one of which is the problem of company productivity. The results of productivity measurements can be used as a guide to determine the level of performance achieved by individuals, groups, industries, as well as overall economic performance, even internationally. Every economic unit or business entity is very interested in productivity analysis because productivity can show an index of business growth from time to time. So that the company is able to find out and improve it so that it is more productive than before. Thus the company is able to compete with competitors. Competition among companies is measured by the level of productivity of the company. Many companies fail in planning production plans so that decreased productivity. This happened in respect to the research object, namely PT Kosmetika Global Indonesia plan failed production causes product completion time not on time. Therefore, it is very interesting to do research on analysis productivity. Productivity is reviewed using the approach of Marvin E. Mundel.

Development of Bicycle Chain Cutting Tools with Quality Function Deployment (QFD) Method

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Research was conducted in the context of the development of bicycle chain cutting tools. The development of bicycle chain cutting tools is very important in meeting consumer needs for these tools to cut chains more effectively and efficiently. In this case, the consumers are mechanics in motorcycle workshops located in the Driyorejo area and its surroundings. Because almost all mechanics are used to cutting chains manually using hammers and nails, based on this background, this study aims to design and make a bicycle chain cutting tool so that mechanics are easier when cutting chains, using the Quality Function Deployment (QFD) method. The stages of research are as follows: (i) consumer needs are identified (the voice of the customer) for bicycle chain cutting tool products; (ii) the needs are translated into product design. Based on the design results using nine attributes and five technical responses, a bicycle chain cutting tool was produced at a selling price of IDR 150,000.00. The advantages of chain cutting tools are that they are equipped with

double clamping, are made of stainless and steel materials, and are easy to operate. The bicycle chain cutting tool can also be disassembled and equipped with a storage box, making it easier to store.

Analysis of Bio-Oil Marketing Strategy in Sumenep

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The range of oil consumption in Indonesia is in the 1,398,496 (barrel/day) to 1.611.599 (barrel/day), where Indonesia is among the top 10 countries with the most use of alternative products that have good quality, recycle waste as raw materials or improve technology that reduces the amount of input, as well as proper marketing initiative in the introduction of new products or innovative products. One of alternative energy is bio-oil. Bio-oil marketing is still limited and very little especially in Sumenep district. This is a lot of people who do not know about bio-oil and do not understand the importance of renewable energy as a replacement for energy from fossil fuels. In this study, bio-oil marketing strategy is carried out using Strengths Weakness Opportunities Threats (SWOT) analysis. The correct strategy used is aggressive (growth-oriented strategy), developing the strength of internal factors and opportunities from external factors as well as the use of the QSPM matrix. Market penetration (T_{as} = 6.84) is the primary option to maximize the strategy applied. The increase in population growth has a significant impact on the demand aspect of a product and presents an exponential pressure on the natural resources used. Appropriate efficiency is required in its implementation. It creates alternative products of good quality, recycling waste as raw materials by using as a whole or mixing with used raw materials or creating technological improvements that reduce the amount of input (such as raw material, soil, energy, and water) needed to produce a single output unit, as well as appropriate marketing initiatives in the introduction of new or innovative products.

Supplier Selection Analysis of Metallic Box Using Fuzzy Analytic Hierarchy Process (AHP)

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Selection is a multi-criterion problem, where each criterion used has a different interest and information about it is not accurately known. In this case, the selection of suppliers based on a low-price offer is no longer efficient. Maximum performance must combine other criteria relevant to the company's objectives. PT XYZ faces problems, related to unstable supplier performance. Instability due to delayed delivery and price exceeding HPS. Therefore, it is necessary to evaluate the supplier. Analytic hierarchy process (AHP) is a method, used in the decision-making process of a complex problem. The use of fuzzy AHP leads to accommodation of the uncertainty that occurs when making decisions. Based on the results of the calculation already done, using the fuzzy AHP method, and assessment, using the rating scale, it was obtained that PT CMP Indonesia obtains a value of 0.4673 with each value for the quality criteria of 0.2803, the delivery criteria are

0.1178, the price criteria are 0.2748, the service criterion is 0.2085, and the performance criteria are 0.1186. From this values, PT CMP Indonesia is the best supplier for metallic box raw materials.

Sustainable Resettlement of Volcano Eruption Victim Case: Sumbermujur, Lumajang

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Semeru is the tallest active mount in Java, located in Lumajang. Victims of the Semeru eruption at the end of December 2021 were relocated to safe areas. One of them is in Sumbermujur. They relocated a whole community as a sustainable settlement. The sustainable settlement provides comprehensive livelihood such as socio-culture, economic and environmental awareness for the survivors. This research emphasizes understanding community environmental awareness. The method is descriptive qualitative. Primary data was obtained through surveys, observations, and interviews. Secondary data come from stakeholders and literature review. The results of this study indicate that the resettlement process in Sumbermujur still needs to be completed after more than one year of the disaster, so this process has yet to achieve its required goal.

Mpu Tantular – State Museum of Indonesia in Sidoarjo

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Mpu Tantular Museum is a State Museum (Museum Negeri), located in Buduran, Sidorajo, East Java, a province of Indonesia. Formerly the Stedelijk Historical Museum of Soerabaia, the museum began as a society established by Godfried Hariowald von Faber in 1933. Today, the museum is the State Museum of the Province of East Java "Mpu Tantular". The General Education Museum was opened to the publics on 23 May 1972 and was inaugurated under the name "Museum Jawa Timur". Furthermore, the initiative arose to hand over this Cultural Institution to the Regional Government of East Java Province. In the process of nationalization, the Public Education Foundation cooperated with representatives of the Museum Development Office of the Ministry of Education and Culture. With the issuance of the Decree of the Minister of Education and Culture dated by 13 February 1974, Number 040/C/1974, the East Java Museum has the status of a State Museum. The inauguration was carried out on 1 November 1974 by handing over from the Chairman of the General Education Foundation for Culture R. Banu Iskandar to the Director General of Culture Prof. Dr. I.B. Spell. Furthermore, the East Java Museum was inaugurated under the name "East Java State Museum Mpu Tantular" with a location on Jalan Pemuda 3 Surabaya. Due to the increase in the collection, in mid-1975, the museum was moved to a wider area, namely Jalan Taman Mayangkara No. 6 Surabaya, which was inaugurated on 12 August 1977 by East Java

Governor Sunandar Priyosudarmo. Subsequently, on 14 May 2004, it occupies a permanent location on Jl. Raya Buduran, Sidoarjo (west of the Buduran Flyover).

Comparison of the Productivity of Seasoning Processing PT. Inti Dragon Suryatama

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PT. Inti Dragon Suryatama is a company, engaged in the production of shoes and slippers, which has the Pro ATT brand issued in 1964. The company can make with a shoes and slippers production capacity of 2000 pcs/hour. Productivity is related to the effectiveness and efficiency of utilization resources (inputs) in producing output. Effectiveness is a degree achievement of the output of the production system and efficiency is a measure that points so far, which resources are used in the production process to produce output. The total productivity index is obtained from a comparison between all outputs (products) with inputs (materials, labor, depreciation, energy consumption and maintenance). In this study, to measure the level of company productivity, the method used is Marvin E. Mundel. The measurement period is from January 2023 to May 2023. Total productivity index of PT. Inti Dragon Suryatama tends to increase but at the end index measurement period has decreasing, compared to the base period. The highest index, occurred in February 2023, was equal to 508.52 % and the lowest index, occurred in April 2023, was equal to 19.86 %. This was due to input of partial input resources, which also fluctuated.

Comparison of the Productivity of Seasoning Processing PT. Daesang Food Indonesia and PT. Miwon

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Gresik Regency is one of the regencies in East Java, which has high potential to develop the cooking seasoning sector, with its main commodity being secondary crops. Based on the Statistical Agency, Gresik Regency has developed 500 ha of palawija crops, consisting of 50 ha of immature plantations, 350 ha of mature plantations and 100 ha of damaged plantations. PT. Daesang Food Indonesia had already measured its productivity, while PT. Miwon had never taken measurements using the Marwin E. Mundel method, so it is needed to take measurements using this method. There are four steps for data processing, using the Mundel method: (i) deflator calculation, (ii) constant price calculation, (iii) calculation of total partial input resources (PIR) and (iv) total output estimation. The results, found by using the Marvin E. Mundel method, include analysis of Material partial productivity index, Energy partial productivity index, Labor partial productivity index, Maintenance partial productivity index, and Total productivity index. Productivity index of partial depreciation increased by 51.69 %, Materials index increased by 53.43 %, Energy index increased by 179 %, Labor index increased by 84.20 %, Maintenance index increased by 173.97 %, Total index increased by 6.08 %.

Proposed Increase in Productivity on the Production Floor Using the Method of Objective Matrix (OMAX) for PT. Inti Dragon Suryatama

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PT. Inti Dragon Suryatama is a manufacturing company, engaged in the processing of the shoe industry. Based on the results of interviews with PPIC, the company has experienced a decrease in the production of Pro ATT shoelace products by around 10 – 20 % in 2022 – 2023. This is one of the company's concerns in increasing productivity. In this study, productivity measurement uses the Objective Matrix (OMAX) method with the criteria, measured according to the conditions of the company and work units performed. The high-performance indicator value in July was 740 while the worst-performance indicator value in March was 135. The productivity index (PI) to standard performance in July reached 146.667 % while the lowest value was in March with a value of 55.000%. The productivity index on performance previously had the highest value in April with a value reaching 176.0 % while the lowest value was in August with a value reaching 71.622 %. Based on the analysis using Fault Tree Analysis (FTA), we can propose several efforts to increase productivity. They include carrying out periodic machine maintenance to anticipate problems that occur in component damage. By detecting failures from the start, preparing a training program needs to be carried out with clear targets according to position work to be improved. Supervision of operators must be carried out routinely to pay attention to operator performance so that all production processes can be controlled according to company standards on the production floor.

Some Applications of a Convolutional Equation in Spaces of Holomorphic Functions of Prescribed Growth

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Let G symbolize a convex bounded region on the complex plane $\mathbf{C}$, $H(G)$ is the space of all functions, which are holomorphic in G, and $V=(\nu_n)_{n=1}^{\infty}$ represent the sequence of functions, continuous in G and increasing within n. Then V defines the following function space:

$$VH(G):=\bigcup_{n=1}^{\infty}H_{\nu_n}(G),\quad H_{\nu_n}(G):=\left\{f\in H(G):\|f\|_{\nu_n}:=\sup_{z\in G}\frac{|f(z)|}{e^{\nu_n(z)}}<\infty\right\},\quad n=1,2,....$$

In this report, we consider some implications of the results on the convolutional equation:

$$\mu * f=g,\quad \mu: VH(G+K)\to VH(G), \tag{1}$$

where μ is an analytical functional with support in K, which is a convex compact in G. The general results of this study are based on proving the conditions for the convolutional operator

surjective between the considered spaces [1]. We discuss the implied properties of (1), including the cases of some concrete instances of μ. Under an additional specific condition that provides injectivity of the convolutional operator, we consider the solution to (1) and propose its applications in engineering: particularly, we state the problem on balancing the turbine unit rotor in the context of generalized assumptions.

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An Effective Method of Pipeline Transport Monitoring

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The problem of non-destructive testing of the state of pipelines is the key to ensuring safety and preventing accidents during the operation of hydrocarbon transportation systems. The main idea of the proposed low-frequency method for diagnosing damage to the pipeline wall is to excite low-frequency oscillations in the test objects with subsequent registration of changes in the parameters of the surface wave field when damage appears or changes in the pipeline wall. The advantage of this approach is the integral nature of the control of the wave process, which makes it possible to assess the general condition of the pipeline by using the miniature film ferroelectric sensors of the generator type with a low own mass and a wide range of operating frequencies. Such sensors have been effectively used in monitoring systems with metal rod or beam structures [1]. The papers [2, 3] show the high sensitivity of the wave field to the properties, structure and stress state of various types of media. The authors of [4, 5] demonstrated the possibility of diagnosing the field of initial stresses by monitoring changes in the dynamic response of the medium. At the same time, the observation of changes in the wave field seems to be a laborious process, which does not allow one to fully assess the nature of the change in the parameters of the medium that provide one or another change in the parameters of the wave process. In [6], a method for mathematical processing of an analog signal is proposed, which converts it into a two-dimensional image. This approach makes it possible to visualize the control of signal changes by converting the original amplitude-time signal to a certain point in two-dimensional space. The method, proposed in this report for monitoring damage to the pipeline wall, is based on the control of changes in the parameters of propagating waves, excited on the surface of an object by a pulsed source, and the subsequent transformation of the initial amplitude-time signal to a certain point on the plane. The object of study is a two-layer pipe, filled with liquid. Simulation of the process of changing the state of the pipe is carried out by changing the position of the inner pipe, weakened by the presence of a pipe defect, in the outer pipe. On the one hand, the dimensions of the pipes ensure their tight contact, on the other hand, they allow us to move the location of the defect. Changing the position of the defect makes it possible to change its parameters and, thereby, influence the structure of the field of surface waves [7]. The aim of the study is to develop a method that makes it possible to detect the movement of a defect by changes in the surface wave field, which is of a complex nature. The

proposed method makes it possible to visualize the control of changes in the position of the defect. It transforms the original amplitude-time signal to a certain point in the two-dimensional feature space. Any change in the position of the defect leads to a change in the position of the point in the feature space. This makes it possible to control the change in the parameters of the defect by the position of the point on the plane. In the studies carried out, a high sensitivity of the proposed approach to changes in damage in the pipe wall was found.

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Basic Concepts for Decision Making Based on Uncertainty: Development of Payoff Matrix

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Condition definition, a form of circumstances that occurs based on various existing backgrounds. This background has various dimensions that influence the formation of various decisions. Changes in conditions from *A* to *B* can also be caused by the entry and development of information, so that the information affects the order of the existing conditions. Receiving information from various sources becomes a record for management to follow up. In general, incoming information sometimes occurs under various conditions, such as certain conditions, uncertain conditions, and conflict conditions. Types of decision-making methods in uncertain conditions are maximax, maximin, equally likelihood (laplace), realism, minimax regret. In this study, to make uncertain decisions on investment in the company, we use the maximax, minimax, equally likelihood, realism, minimax regret methods. The measurement periods are the new and old school years. The results of a case study of decision making, based on uncertain conditions, namely for the maximax method the choice of factory investment were obtained for PT. Goldfindo. The maximin method, the equal likelihood method, the realism method and the regret minimax method were applied to PT. Tjakrindo mas.

Productivity Measurement Using the OMAX (Objective Matrix) Method

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Productivity is the ratio between output and input. Output is the result of a process in the form of goods or services, while inputs are the sources used to obtain these results such as raw materials, labor, machinery, and energy, capital, technology and production equipment. Objective Matrix (OMAX) combines productivity criteria into an integrated form and relates to one another. OMAX is a performance measurement method that evaluates several productivity criteria with weights to obtain an overall productivity index. This model proposes productivity development at the activity level. The OMAX method is important for ease of application. This method is also useful for projects and service functions that are difficult to measure productivity. In this study, to measure the company's productivity index, the OMAX method was used to determine how much productivity in 15 periods starting from January 2021 to March 2022 with 7 inputs or criteria. The OMAX method is used as a productivity index measurement method by focusing on production costs as inputs (raw materials, labor, machinery, energy consumption, capital, technology, and production equipment) and sales results as outputs. The results of the productivity index for PT Emi were the following: the performance indicator was 1.82 in February 2021, 0.51 in April 2021, 0.08 in August 2021, 1.38 in October 2021, 12.3 in January 2022 and 0.38 in March 2022.

Microwave Absorbing Properties of Modified Bismuth Ferrite in the Microwave Range

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Currently, multiferroics based on bismuth ferrite ($BiFeO_3$) are among the promising materials for microwave absorbers. Many works are devoted to the study of the influence of the magnetic subsystem on the microwave absorbing properties, since it is believed that its presence is the determining factor in achieving the best microwave absorbing properties of materials. The main trend in the study of the properties of polycrystalline materials based on $BiFeO_3$ in electromagnetic fields of the microwave range is the study of solid solutions with its participation, modified with various doping elements. The paper considers the microwave absorbing properties of holmium-modified bismuth ferrite and their dependence on the concentration of the modifier. Polycrystalline cylindrical $BiFeO_3$/Ho samples were studied by three different methods, which made it possible to compare the level and width of the absorption band of the samples both qualitatively and quantitatively, as well as to exclude or confirm the resonant nature of the absorption maxima. The studies were carried out at room temperature in the frequency range from 300 kHz to 26.5 GHz

using microstrip measuring cells of various configurations. It has been experimentally established that the height of the cylinders and the accuracy of the location of the samples in the measuring cell have little effect on the measurement results. It is shown that the introduction of low concentrations of Ho (5 and 10 mol.%) increases the overall level of losses in the material without changing the frequency distribution (frequency range with a relatively high absorption level of 7 – 12 GHz). When the content of Ho is from 15 to 20 mol. % in $BiFeO_3$, the absorption bands shift towards higher frequencies (10 – 14 GHz). The nature of the absorption maxima is non-resonant. It should be noted that the overall level of absorption of the studied materials is on average 25 % lower than industrial microwave absorbers based on carbonyl iron and epoxy resin.
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Resonant Microwave Response in Lead Zirconate-Titanate Ceramics Rich in Zr

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Barium-strontium titanate and lead zirconate-titanate are currently considered the most suitable ferroelectric materials for microwave resonators, filters, and phase shifters. However, at present, not much attention is paid to the electrodynamic properties of these materials in the areas of concentration and temperature phase transitions. The purpose of this study was to determine the nature of the resonant behavior of the $PbTi_{0.03}Zr_{0.97}O_3$ ceramic samples in the vicinity of the high-temperature ferroelectric-antiferroelectric phase transition. Temperature dependences of the *S*-parameters of a cylindrical sample of 1 mm height and 10 mm in diameter in the frequency range from 300 kHz to 26.5 GHz were obtained using a vector network analyzer and a waveguide measuring cell with a heating element. The minima of the transmission coefficient, coinciding with the maxima of the reflection coefficient, were determined as resonant minima. To confirm the resonant nature of these features, a measuring cell with two parallel electrically uncoupled microstrip lines was used. The nature of the singularities that occur in the frequency dependences of the scattering matrix elements, some of which have a resonant character, is determined. It is found that as the phase transition from the antiferroelectric to the ferroelectric state is approached, the resonant minimum shifts monotonically to lower frequencies. At the moment of transition, a sharp increase in the resonance frequency is observed, accompanied by a significant decrease in the level of resonant losses. The complete disappearance of the resonance behavior in the ferroelectric phase is expected. This phenomenon is observed both in the heating and cooling modes and is characterized by a significant temperature hysteresis, which correlates with the low-frequency dielectric response of the samples. The results obtained are consistent with preliminary studies of the behavior of the microwave response of binary systems with a different ratio of components. The paper considers possible physical mechanisms responsible for the formation of such a microwave response.
Acknowledgement. The study was carried out with the financial support of the Ministry of Science and Higher Education of the Russian Federation (State task in the field of scientific activity in 2023), project No. FENW-2023-0010/(GZ0110/23-11-IF).

Evaluation and Productivity Analysis Using Mundel Method in PT. AFM

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Competition between companies is measured by the level of productivity of the company. Many companies fail to design production schedules so productivity drops. This report studies PT. AFM. Productivity measurements should be used to analyze and evaluate the factors that affect the performance of the company and act as the basis for increasing productivity for the company, with the help of business strategies to increase competitiveness. Meanwhile, the company to date, using a simple method to measure the level of productivity, that is divide the amount of product or the value of the product produced on all the costs associated with the product. Of course, this does not specify exactly what factors affect productivity. Therefore, a way is needed to measure the level of productivity of an enterprise that can describe the impact of input factors on productiveness. Therefore, it is necessary to measure productivity using the Mundel method, as this method can describe the factors that affect the level of productiveness. The Mundel method is used to determine the input that has the greatest influence on the product. Input consists of five factors: capital, direct labor, indirect labor, raw materials, energy consumption, maintenance of machines and equipment. Data processing is carried out using the above method and entering data for one year, that is from January to December 2014. From the results of data processing, analysis and discussion, the information about the productivity of the company can be obtained. With five inputs, productivity levels vary at each measurement period. The contribution of capital, labor, energy and maintenance of machinery, equipment and materials were decreased, compared to the reference period. This is because input growth is not followed by output growth. The results of data processing, analysis and evaluation show that the Mundel method can be used to gain an insight into the factors, affecting the productivity of the company.

Automated Control System for the Carbon Monoxide Conversion Unit

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The conversion of carbon monoxide (CO) is an important process in industry and air. CO conversion involves converting gaseous emissions containing CO into safer waste products such as carbon dioxide (CO_2). CO conversion is carried out with the help of catalysts [1]. There are two main methods of CO conversion: catalytic conversion and oxidative conversion. Catalyst conversion is carried out using catalysts that promote the reaction between CO and other chemicals such as hydrogen and oxygen. One of the most effective catalysts for CO conversion is platinum [2]. Oxidative conversion is carried out using oxidizing agents such as oxygen or nitrogen dioxide (NO_2). Oxidative conversion methods require higher temperatures and pressures to carry out the reaction [3]. Automation of the carbon monoxide conversion process can be achieved using various technologies and process control systems [4]. For example, we can use automatic controllers that control and regulate process parameters such as temperature, pressure and gas

concentration. They can also make decisions, based on data received from sensors and monitors. As part of the work of a team of authors, an automation system for the second-stage carbon monoxide conversion unit was proposed, which makes it possible to ensure the optimal conduct of the technological process and trouble-free operation of the equipment [5]. APCS is a set of software and hardware tools that implement the following functions: issuance of operational information about the progress of the technological process at information display stations, regulation of technological parameters, collection and archiving of operational information about the operation of the installation, control of emergency deviations of technological parameters, automatic protection and blocking of equipment.

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Productivity Analysis Using Marvin E. Mundel Method (Study Case In PT. PC)

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The development of the ceramic or tile industry in Indonesia is growing, which requires each company to increase competitiveness and create innovative ceramic motifs that follow consumer tastes from year to year. To find out the level of competition among ceramic industry companies in Indonesia, it can be measured from the level of productivity in the company. PT PC is one of the largest ceramic industry companies in Indonesia, which is currently growing and is creating new innovations in the ceramic industry in Indonesia. However, while the company only sees profits from production sales as a measure of the company's productivity. Therefore, PT PC needs to conduct a more detailed measurement of productivity. The Marvin E. Mundel method is used as a productivity measurement method by focusing on production costs as inputs (machine

depreciation costs, materials, labor, machine maintenance, energy consumption and utilities) and sales results as outputs. From the productivity measurement, it is obtained that the highest partial productivity index achieved by the company occurred in May 2022, namely 127.43 % for machine depreciation, 329.79 % for materials, 127.43 % for labor and 142.23 % for energy consumption and utilities; in November 2021, machine maintenance attained 171.54 %. Meanwhile, the lowest partial productivity index, achieved by the company, occurred in June 2022, which was 37.54 % for machine depreciation, 37.54 % for labor, 41.89 % for energy consumption and utilities; in May 2021, it was 59.76 % for machine maintenance and in December it was 33.61 % for materials. The highest total productivity index was achieved in May 2022 equal to 216.12 % and the lowest value of 43.71 % was in December 2022. Based on the measurement results and productivity evaluation, results for productivity improvement in PT PC can be attained by improving each of the inputs such as increasing maintenance and care of production machinery, increasing supervision of employees, increasing control over materials sent by suppliers, and so on.

Experimental and Theoretical Study of Site-controlled Formation of Droplet Epitaxial In/GaAs(001) Nanostructures with a Variable Distance

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Formation of ordered arrays of pre-defined nanoholes on a substrate allows prediction of nucleation sites and geometrical parameters of quantum dots (QDs) epitaxially grown on this substrate. This approach simplifies further post-processing of heterostructures and provides a better production yield of QD-based devices. Although much attention is paid to regular arrays of nanostructures, site-controlled growth of QDs with a variable distance is also important for specific applications, such as lasers on whispering gallery modes, nanoelectronic cellular automata or quantum computation schemes based on QD molecules.

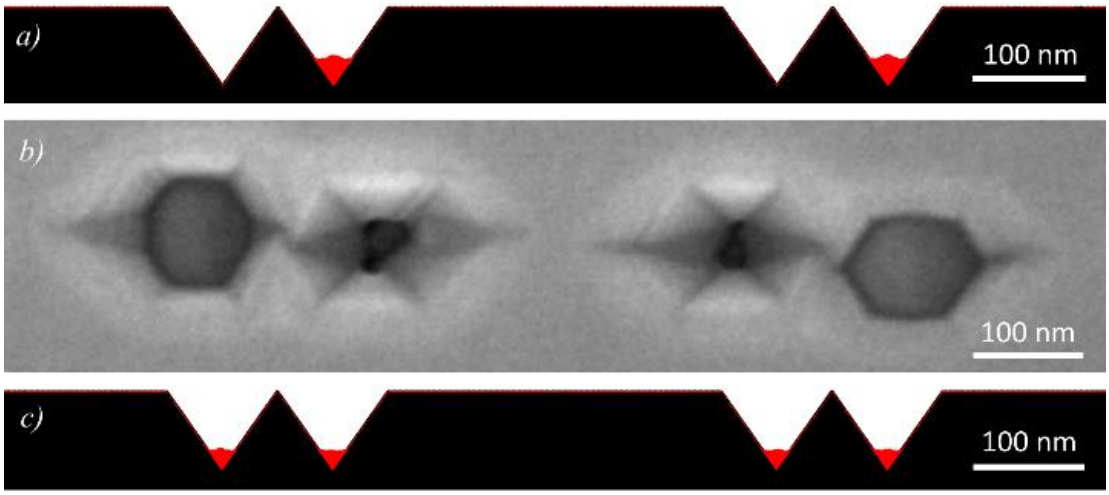

Fig. 1. Morphology of droplet arrays, obtained on patterned surfaces at 300 °C: (a) simulation and (b) SEM image; (c) simulation for a case of 200 °C.

In this report, we carry out a complex experimental and theoretical study of droplet epitaxial (DE) growth of In/GaAs(001) nanostructures on surfaces, modified by focused ion beams (FIBs). Experimental study of the DE growth on patterned surfaces demonstrated that droplets tend to occupy hole positions, except for the case of 250 °C when one droplet was formed beyond holes.

However, droplets are not evenly distributed over all holes, which is due to intensive decay of subcritical islands. It was also found that it is possible to create arrays of In droplet pairs with close-to-unity filling of holes, located at a distance of 1 μm.
Simulations based on a kinetic Monte Carlo model [1] demonstrated that a temperature of 300 °C is also high to provide formation of site-controlled droplet pairs, located 500 nm apart (see, Fig. 1a,b). A decrease in the temperature to 200 °C leads to 100 % filling of holes with absence of droplets beyond (see Fig. 1c). The same temperature was found to be optimal for the site-controlled growth of droplets on patterned surfaces with a distance changing from 20 to 340 nm. A large diffusion length of adatoms at 250 °C does not allow to fill closely located holes with droplet material. A decrease in the temperature to 150°C leads to undesirable nucleation outside the holes.
Acknowledgement. This study was supported by the Russian Science Foundation Grant No. 21-79-00310, https://rscf.ru/project/21-79-00310/, at the Southern Federal University.
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Impedance Spectroscopy Study of $0.7Pb(Mn_{1/3}Nb_{2/3})O_3 – 0.3PbTiO_3$ Ceramic

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Impedance spectroscopy is a powerful technique used for studying the electrical properties of materials, including ceramics, over a range of frequencies. In the case of $0.7Pb(Mn_{1/3}Nb_{2/3})O_3 – 0.3PbTiO_3$ ceramic, which is a solid solution of lead manganese niobate (PMN) and lead titanate (PT), impedance spectroscopy can provide valuable information about its electrical behavior, including dielectric, ferroelectric, and conductive properties. Complex impedance measurements were performed using a PARSTAT 4000 impedance analyzer, and the obtained data were analyzed by fitting them to an equivalent circuit model. The R-CPE (resistor-capacitive pseudo element) circuit model provided a good fit to the spectra at different temperatures. The observed decrease in grain and grain boundary resistance with increasing temperature (see Fig. 1) suggests a reduction in barriers to charge transport.

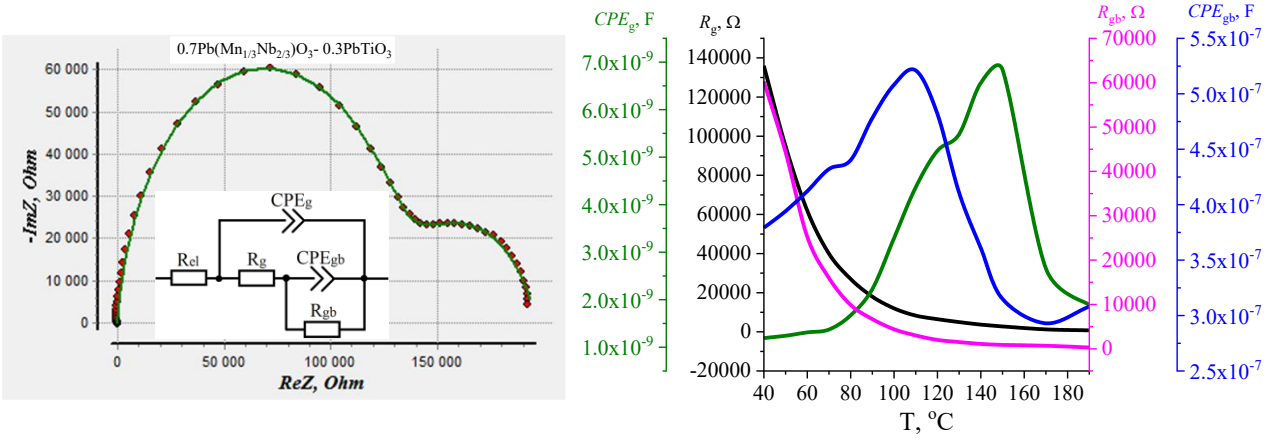

Fig. 1. Impedance spectra and fitting results of $0.7Pb(Mn_{1/3}Nb_{2/3})O_3 – 0.3PbTiO_3$ ceramic.

This could be attributed to enhanced mobility of charge carriers or a decrease in the number of defects or impurities that hinder charge transport at higher temperatures. On the other hand, the observed increase in grain and grain boundary capacitance until reaching a maximum, followed by a decrease with increasing temperature, is consistent with the dissolution of the charge responsible for the Maxwell – Wagner relaxation. The phenomenon of Maxwell – Wagner relaxation occurs due to the accumulation of charges at interfaces between regions with different electrical properties, such as grain and grain boundaries, resulting in a capacitive response in the impedance spectra. The dissolution of these charges at higher temperatures could lead to a decrease in the observed capacitance. It's worth noting that the behavior of the ceramic with temperature may be influenced by various factors, including the composition, microstructure, and thermal history of the material.

Control of the Morphological Characteristics of Pt/C Catalysts by Obtaining Liquid Phase Synthesis

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At present, scientists are actively developing in the field of application of electrocatalysts in proton exchange membrane fuel cells. The most effective catalyst for such a device is Pt nanoparticles, distributed on the surface of the carbon support. There are many different ways to produce Pt/C catalysts, in the result of which materials with different amounts of deposited platinum particles and various structural and morphological characteristics can be obtained [1]. Varying the volumes of reagents added, the ratio Pt:OH during synthesis, temperature, holding time, addition of surfactants and other parameters, it is possible to control the physical and electrochemical properties of the materials being studied, the distribution of Pt particles over the surface of the support [2]. In the course of the study, we obtained highly efficient electrocatalysts that are distinguished by a uniform distribution of platinum nanoparticles over the support surface, a narrow size distribution, and a small nanoparticle size of 1.8 – 2.2 nm (see, Fig. 1).

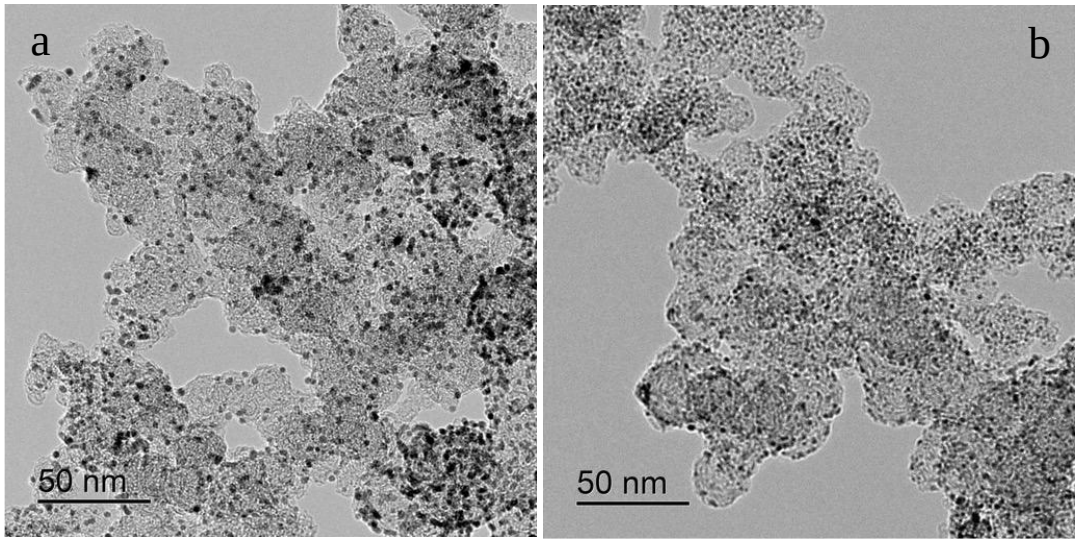

Fig. 1. Micrographs of the Pt/C samples (formaldehyde synthesis method with 20 % platinum loading on Vulcan XC-72), obtained by (a) the standard synthesis method and (b) modified synthesis method of Pt/C catalyst with the use of a stabilizing agent.

Acknowledgement. The study was carried out with the financial support of the Ministry of Science and Higher Education of the Russian Federation (No. FENW-2023-0016).

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Application of the Integer Programming Method to Calculate the Minimum Production Costs and Dietary Requirements

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The purpose of this study was to determine the minimum expenditure, related to nutritional composition. Determination of the nutritional composition was performed by implementing the integer programming method (ILP). The integer programming method considers the cost limitations of the total nutritional needs and has unanimous results. To solve this optimization problem, the LINGO software application is used. In this optimization, seven decision variables were used, namely: X_1 (amount of rice), X_2 (amount of chicken), X_3 (amount of tofu), X_4 (amount of vegetables), X_5 (amount of eggs), X_6 (amount of bananas), and X_7 (amount of milk). Seven types of nutritional needs consist of protein, fiber, carbohydrates, calories or energy, vitamins, fats, and calcium. The seven types of nutritional needs are defined as a function of constraints. The formulation to determine the minimum expenditure value is Minimum = $5{,}000X_1 + 15{,}000X_2 + 3{,}000X_3 + 4{,}000X_4 + 2{,}000X_5 + 1{,}000X_6 + 5{,}000X_7$. The value of the objective function (objective value), shown by the output of the LINGO program is 55,000, that is this value meets nutritional needs.

Study of Various Approaches to the Synthesis of PtCo/C and PtNi/C Electrocatalysts for Fuel Cells

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Proton exchange membrane fuel cells (PEMFC) represent a promising technology for use as portable current sources in the cycle of environmentally friendly energy. The main obstacle to large-scale commercialization is the high cost of fuel cells, a significant part of the price of which falls on a catalyst, consisting of Pt nanoparticles. Doping of Pt with different *d*-metals (Fe, Co, Ni, Cu) reduces the platinum content in the catalyst by increasing the catalytic activity of

nanoparticles. The purpose of this work is to carry out the synthesis of bimetallic PtCo/C and PtNi/C catalysts by the polyol method and to study the effect of the introduction of $NaBH_4$ into the reaction mixture (as an additional reducing agent) and the value of pH on the obtained materials characteristics. The obtained samples were studied by XRD, TGA, TXRF, cyclic voltammetry and linear voltammetry on a rotating disk electrode (RDE) in a three-electrode electrochemical cell. According to the TGA data, the mass fraction of platinum in the samples synthesized without the addition of $NaBH_4$ turned out to be significantly less than that laid during synthesis. The composition and size of the crystallites of the metal component were determined from the XRD data according to Vegard's law and the Scherrer equation, respectively. The analysis showed that the reduction of cobalt or nickel occurs only in an alkaline medium. In addition, nanoparticles of materials synthesized in an alkaline medium have a smaller crystallite size. It was shown that increasing the pH of the medium during polyol synthesis facilitates the reduction of cobalt or nickel and reduces the average size of metal crystallites of the materials obtained and increasing of ESA value and catalytic activity. The introduction of $NaBH_4$ into the reaction mixture as an additional reducing agent makes it possible to obtain materials with a mass fraction of platinum close to the theoretical one and high activity in oxygen reduction reaction (ORR). Thus, the optimal approach is a combination of high pH with the addition of $NaBH_4$.

Acknowledgements. The study was carried out at the Southern Federal University with the financial support of the Ministry of Education within the framework of the project GZ110/23-07-XF.

Getting the Duration of Rigid Pavement Work

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One of the problems that exist in toll road sections is the occurrence of several types of damage at the same location. The damage is immediately repaired without waiting for it to become more severe. In the result of the large volume of vehicles passing through this toll road, the initial condition of the subgrade is not good, resulting in frequent recurring damage. Based on the results of surveys and research conducted, the type of damage and the method of repair carried out by the toll road operator are determined. So, the types of damage that occur are cracks, faults, pumping, and holes. The cost of the project is very influential on the results and affects the results and implementation time of the construction of this toll road project. So, that the implementation of the project does not cause delays and cost overruns, it must be held for additional working time or accelerate the work schedule at certain times with additional labor. Efforts to optimize the desired time duration with low-cost increases can be made through an analysis of the calculation of project time and cost in accordance with the drawing plans and specifications of the project's implementation to be able to carry out the best planning. So, the utilization of work implementation becomes more efficient, and the construction of this toll road project gets done at the optimal time with a low total cost. Performance evaluation is necessary for the company's business to operate effectively in a changing business environment. This function is necessary for the survival of the company. Performance evaluation is defined as the process required to measure actions on the base of qualifications and performance.

Propagation of SH-waves in Structures of Functionally Graded Piezoelectric, Piezomagnetic and Dielectric Layers

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In this report, we develop the approach, proposed in [1 – 5] for studying the features of SH-wave propagation in composite plates from functionally graded piezoelectric (PE), piezomagnetic (PM), and dielectric (DE) layers. Combinations of components PE/DE, PM/DE and PM/PE are considered. Modeling of layer heterogeneity is based on the use of a two-component model, in which the physical properties change continuously in a monotonic or non-monotonic manner over the thickness from the parameters of the base material to the parameters of the inclusion material. The possibility of different localization of inclusions along the layer thickness is implemented. The inhomogeneity of the dielectric layer models the interpenetration of layers in a narrow transition region near the interface. It was assumed that the density, dielectric and elastic moduli of the dielectric layer continuously change in thickness from the corresponding parameters of the piezoelectric or piezomagnetic material to the parameters of the base material of the dielectric. The problems of propagation of surface SH-waves from a remote source of harmonic oscillations in composite plates $CoFe_2O_4/SiO_2$, PZT/SiO_2 and $CoFe_2O_4/PZT$ are considered. It is assumed that the outer surfaces are free from mechanical influences, electrically free and magnetically closed, or electrically shorted and magnetically free. The influence of the thicknesses, nature and localization of the inhomogeneity on the SH-surfactant velocity and the magnetoelectromechanical coupling coefficient in a wide frequency range has been studied. The present study is of practical interest for the development of new layered composites made from intelligent piezoelectric and piezomagnetic devices for engineering applications.

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Make an Ergonomic Desk

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We visited in cafes for observing work facility objects that are not ergonomic. There are cafe tables that are not ergonomic and can disturb the comfort of the cafe visitors. So, we designed non-ergonomic work facilities to become ergonomic work facilities and that visitors feel very comfortable in visiting the cafe and not easily tired and bored. Themeasurement table became a result for the old and new work facilities. From these calculations, we can design an ergonomic table. Anthropometric data refer to measurements and characteristics, related to the human body's size, shape, proportions, and physical attributes. It involves collecting quantitative data about various body measurements and features of individuals or populations. Anthropometric data are essential in various fields, including ergonomics, health and fitness, clothing and apparel design, architecture, and product design. It provides valuable insights into the diversity of human body sizes and shapes, enabling the development of products, spaces, and services that can accommodate a wide range of individuals.

Material Requirement Plan to Souvenir Master Production Schedule

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Heizer and Render (2005) state that Material requirement plan (MRP) is a bound demand model that uses lists of material requirements, inventory status, estimated receipts, and master production schedules, which are used to determine the material requirements to be used. Schroeder (1994) mentions MRP as an information system used to plan and control inventory and capacity. Tampubolon (2004) states that MRP is a computerized inventory system for all materials needed in the conversion process of a company, both manufacturing and service businesses. Based on the definitions put forward by some of the experts, referred to above, MRP can be interpreted as a method of planning and controlling materials (raw materials, parts, components, and subcomponents) that are tied to the production units to be produced, using an integrated system. The MRP system is structured with the intention of answering the question of when, how much, and what raw materials are needed in a timely and efficient manner. The MRP method provides advantages, such as reducing inventory and storage costs, providing information to support appropriate actions in the form of canceling orders or rescheduling, it can also be a new decision or an improvement over past decisions taking into account existing production capacity.

Productivity Analysis Using Marvin E. Mundel Method (Study Case in CV. Gavra Perkasa)

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Competition in many companies can be measured by the level of productivity of the company CV. Gavra Perkasa Gresik is a manufacturing company engaged in the wood processing industry, among the works produced is turning. So far, the company has never made productivity measurements so that, if output is low, the company thinks it is not good without analyzing the causes specifically and not paying attention to the efficiency of the use of resources (inputs) that are owned. Productivity measurement to find out how the condition of the company's productivity, whether experiencing an increase or decrease, is necessary to measure productivity using the Marvin E. Mundel model. This measurement is carried out, based on labor input, material, energy consumption, financing and total input. The data needed for productivity analysis is taken from 2016 as the base period and 2017 as the measurement period. The results of calculation of productivity using the Mundel model show that not all inputs have decreased, causing the company's total productivity equal to 98.18%, which has a good impact on the company.

Productivity Analysis Using Objective Matrix Method (Study Case in Bottle Drink Company)

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Productivity is one of the indicators of a company's performance. In 2018, a company in the Banten area will have difficulty achieving its production targets, compared to previous years. This condition causes the company's overall productivity to decline. This study aims to evaluate the decline in productivity by measuring the value of productivity based on three criteria, namely production efficiency criteria, effectiveness criteria, machine working hour criteria. The method used is the Objective Matrix (OMAX), with the steps: criteria, ratio calculation, calculation of the interpolation of the matrix value, goal setting, while the company determines the weight, and matrix formation. The highest score of productivity in the production during 2018 occurred in period 7, with a value of 455.7, while the lowest cost of productivity occurred in period 1 with a score of 196.35. Criteria that do not contribute to productivity and need to be improved are production efficiency criteria, because the importance of these criteria shows below-standard performance. In contrast, the criteria of effectiveness and inferential criteria (machine working hours) indicate an amount that tends to be good. The quality and efficiency of raw material usage have a vital role to increase productivity with a ratio of 3 and to create an efficient production system.

Productivity Measurement Using the Marvin E. Mundel Method: Marvin E. Mundel and Productivity Evaluation Tree (PET)

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The development of the manufacturing industry requires business actors to continue increasing the competitiveness of the products they produce. Competition among companies is measured by the level of productivity of the company. Productivity measurement can show the results of measuring a performance by showing the resources used so that efficiency and effectiveness can be achieved. PT. Garuda Jaya is a manufacturing company that produces leather shoes. In previous years, this company only conducted external and internal audits to see whether the company was at the expected level of productivity or not. The Marvin E. Mundel method is a way to measure productivity levels by focusing on costs with the input of material, labor, energy and maintenance costs and income as output, with the measuring period January 2017 to December 2018. Total productivity in the company obtained the highest index of 153.07 % in December 2018 and the lowest index of 69.80 in August 2018. Productivity evaluation used a Productivity evaluation tree (PET). The resulting total productivity is alternative to 7 with a value of 0.650 which needs to be improved or minimized in terms of energy use in the company.

Reconstruction of Prestresses in Round and Annular Viscoelastic Timoshenko Plates

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At present, new materials with a complex inhomogeneous structure are actively used in many areas of modern science and production. Among them, one can point functionally graded polymeric materials (FGPMs) and composites, which are used in the aircraft industry, space technologies, in the development of "smart" systems, and in prosthetics in medicine. At the same time, it is important to take into account the factor that most technological processes for the manufacture of FGPMs involve the appearance of prestress (PS) fields in them, which have a significant impact on the reliability and performance of products. The processes of polymerization, crystallization and cooling of the finished product, as well as subsequent creep and relaxation, which are characteristic of viscoelastic bodies, are the causes of the occurrence and determine the level and distribution of the prestressed-strain state in products. The manufacturing technologies used, on the one hand, make it possible to avoid the appearance of microdefects, cracks and delaminations in the FGPMs, on the other hand, this leads to the formation of residual stresses and deformations, which significantly affect the mechanical characteristics of the material. Taking into account these factors, the inverse problems of the reconstruction of the PS in objects during control procedures after manufacture and in the process of operational monitoring are of particular practical importance. To solve such problems, special diagnostic non-destructive techniques are required that meet the requirements for accuracy and ease of practical implementation, for example, methods based on the acoustic approach. In this report we present the development of the study of

prestressed circular and annular inhomogeneous plates from FGPM in the framework of Timoshenko's hypotheses, taking into account the presence of their viscoelastic (rheological) properties. To describe the rheological properties and damping, a three-parameter model of a standard viscoelastic body (which includes instantaneous and long-term moduli, as well as relaxation time) was used. Models of steady oscillations of the plates under consideration are constructed, for which the Volterra correspondence principle was used, which makes it possible to replace the elastic moduli in the previously obtained formulations for elastic plates with complex moduli, depending on the radial coordinate and oscillation frequency. The previously developed method for solving direct problems of calculating oscillations, based on the Galerkin method, was adapted accordingly, taking into account the fact that the functions included in the formulations are complex-valued. The accuracy of the proposed technique was analyzed in comparison with the analytical solution in the case of homogeneous plates. An analysis was also made of the influence of both the PS level and the relaxation time on the amplitude-frequency characteristics and deflection functions. Within the framework of the formulations obtained for viscoelastic plates, new inverse problems were formulated for determining the PS from information about the acoustic response. To solve these inverse problems, taking into account the complex-valued functions included in them, the previously developed special projection approach was adapted. The results of corresponding computational experiments on solving direct and inverse problems are presented.
Acknowledgement. The study was carried out with the financial support of the Ministry of Science and Higher Education of the Russian Federation (State task in the field of scientific activity, scientific project No. FENW-2023-0012).

Effect of Cobalt Oxide Content on Photoconductivity of Co_3O_4 – ZnO Films

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As an additive to zinc oxide (ZnO), semiconductive *p*-type oxides such as nickel oxide (NiO), copper oxide (CuO), cobalt oxide (Co_3O_4), etc., are popular, which allow the creation of *p-n* transitions. Of these, the most promising is Co_3O_4 spinel, which is a mixed oxide of Co^{3+} and Co^{2+}, characterized by the presence of indirect and double bandgaps of 2.2 and 1.6 eV [1]. For the study, thin nanocomposite films, based on zinc oxide with a content of 1 – 10 mol % Co_3O_4, obtained by solid-phase pyrolysis, were taken [2]. The reaction to light with a wavelength of 660 nm of zinc oxide films with an admixture of cobalt oxide, obtained by solid-phase pyrolysis (1% Co – 99% Zn, 3% Co – 97% Zn, 5% Co – 95% Zn, 10% Co – 90% Zn) was studied, see Fig. 1. The temporal parameters of the photoresistance change were also determined. The response time of the samples ($t_{0.9}$) and the time constant (τ) were evaluated. Response time is the time during which the readings (R/R_0) of the measured value are in the range of 90 % of the maximum value, $\Delta(R/R_0)_{max}$. Time constant characterizes the average lifetime of photogenerated charge carriers and is calculated by the equation: $R/R_0 = \Delta(R/R_0)_{max}(1 - e^{-t/\tau})$. Figure 1 clearly shows the pattern of reaction changes on the Co_3O_4 concentration. The response time and constant time, when exposed to radiation with a wavelength of 660 nm, were equal for the samples: 1% Co – 99% Zn (2 and 7 s), 3% Co – 97% Zn (2 and 6 s), 5% Co – 95% Zn (2 and 5 s), 10% Co – 90% Zn (2 and 4 s). With an increase in the concentration of cobalt oxide in Co_3O_4 – ZnO films, the response time decreases and the response amplitude increases, respectively. It can be concluded that at 10 % cobalt oxide content, the response time will be minimal, and the amplitude of the response is maximal. The results

obtained can be used in the development and formation of solar cells, based on oxide semiconductors.

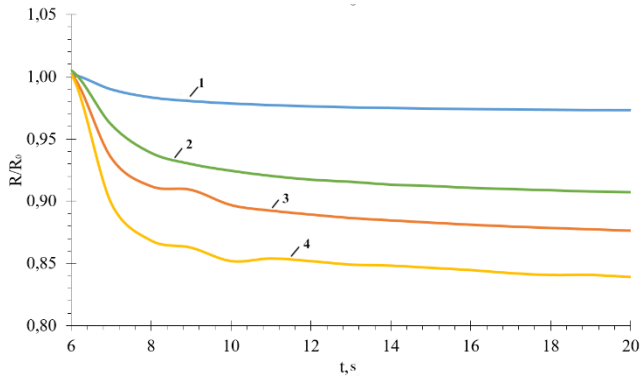

Fig. 1. Time dependence of the normalized resistance under the influence of radiation on the samples: (1) 1% Co – 99% Zn, (2) 3% Co – 97% Zn, (3) 5% Co – 95% Zn, (4) 10% Co – 90% Zn

Acknowledgement. The research was carried out at the expense of a grant from the Russian Science Foundation (project No. 22-29-00621, https://rscf.ru/project/22-29-00621/) at the Southern Federal University.

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The Management and Financing System for the Healthy Pekanbaru Program for the Poor in Pekanbaru, Indonesia

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Health financing is an important instrument in the context of fulfilling the people's right to health as mandated by the 1945 Constitution. Law No. 24 of 2011, concerning the Social Security Administrative Body, regulates that health financing is carried out, based on the principle of mutual cooperation which is divided into 3 (three) forms, namely: (i) financing through the APBN, (ii) financing through the APBD, and (iii) financing by participants or other parties on behalf of the participants. Moving from these provisions, the regions prepare budgets for health financing in the regions. With the repeal of the Pekanbaru City Jamkesda, the Pekanbaru City Government issued a Healthy Pekanbaru Program policy. This study aims to analyze the financing of the Healthy Pekanbaru Program, issued by the Pekanbaru City Government, to substitute for the Jamkesda Program. This research is descriptive legal research with a normative juridical approach. The data used is secondary data and collected through library research. The collected data were analyzed in a qualitative descriptive manner and then presented in an analytical descriptive manner. Based on the results of the research conducted, it was found that the health financing model, adopted in the Pekanbaru Sehata Program, is the health insurance model, which is part of the National Social Security System. The funding for the Healthy Pekanbaru program is funded through the Pekanbaru City APBD which is managed by the Pekanbaru City Health Service and channeled through Health service facilities, owned by the Pekanbaru City Government and other

health facilities, that have collaboration with the Pekanbaru City Health Service. The challenges, faced by the Pekanbaru City Government in implementing the Healthy Pekanbaru program, include: (i) relation to the transition of Jamkesda membership to the Healthy Pekanbaru Program, (ii) integration between the Healthy Pekanbaru Program and JKN and (iii) integration between the Pekanbaru City Health Office and BPJS and health service facilities.

Management and Strategy for Handling Former Narcotics Addicts through the Indonesian Drug-Free Healthy Young Generation Program at the Kediri Indonesia Eklesia Social Institution

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We use the SEM method to measure and create a model for narcotics rehabilitation which has so far experienced many challenges in making efforts to heal through rehabilitation as a result of various problems that are internal regulations or external policies. Our findings illustrate that so far victims of narcotics use are actually victims who later become perpetrators, so they are assigned criminal sanctions due to the ambiguity of regulatory policies. In addition, it is still found that the existence of rehabilitation institutions is also used as business objects by criminals to free themselves from the threat of punishment even though this rehabilitation is really needed by victims. So, the success of rehabilitation will certainly reduce the chain of illicit business of narcotics distribution.

Study of the Nanosecond Repetitively Pulsed Discharges Effects on the Technological Properties of Sulfide Minerals from Low-Grade Copper-Nickel Ores

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Nanosecond repetitively pulsed discharges are used for the effective action of the high-voltage electric fields, generation of the non-equilibrium plasma in air at atmospheric pressure and production of ionized species. The pulsed energy impacts are promising methods for the pretreatment of refractory mineral raw materials (refractory ores and concentration products) to increase the disintegration, softening, and liberation performance of finely disseminated mineral complexes, as well as the contrast between the physicochemical and process properties of mineral components [1 – 3]. In this work, we used analytical electron microscopy, electrode potential testing, sorption and flotation measurements to study changes in the surface morphology, electrochemical, physicochemical, and flotation properties of the natural pyrrhotite, pentlandite and chalcopyrite exposed to non-thermal action of the repetitive high power nanosecond electromagnetic pulses (HPEMPs) and low-temperature plasma of dielectric barrier discharge (DBD) in air at atmospheric pressure. Sulfide minerals were extracted from the low-grade copper-

nickel ore of the one Russian deposit. The action of HPEMPs caused a subsequent different change in the electrode potential of pyrrhotite and pentlandit, namely, an increase in the negative value of the electrode potential of pyrrhotite and an increase in the positive value of the pentlandite potential. We have established an increase in content of oxidized ferric iron on the pyrrhotite surface. The shift of the pentlandite electrode potential to the region of more positive values increased the anionic collector adsorption and the hydrophobization of the mineral surface. The transition of the pyrrhotite potential to the region of negative values prevented the xanthate adsorption and decreased the mineral floatability. For monomineral flotation of pyrrhotite and pentlandite, we established the optimal mode (t_{treat} = 10 s) of preliminary electromagnetic pulsed processing of minerals, at which the contrast of their flotation properties increases in the mean on ~20%. Short-term (t_{treat} = 10 s) treatment of pyrrhotite by atmospheric pressure plasma of DBD caused the largest changes in the electrode potential of this sulfide mineral in the range of pH 9.7 – 12. The shift of the electrode potential to the region of negative values (– 60 mV) occurred, which causes the effect of a decrease in the sorption and flotation activity of pyrrhotite. The HPEMP effect provoked the growth of the electrode potential of chalcopyrite by 25 mV on the average in pH range from 6 to 10. As UV-spectroscopy data show the improvement of potassium butyl xanthate sorption on chalcopyrite, treated by HPEMP. For the mode of short-term (5 – 10 s) treatment, the increased floatability of chalcopyrite from 75 % up to 92 % due to a greater amount of a collector was accumulated at sulfide surface and its higher electrode potential established. In experiments on the comminution and flotation of a low-sulfide product (ore charge) of disseminated and cuprous copper-nickel ores (Fe = 11.5 %, Cu = 0.88 %, Ni = 0.46 %), we obtained the following results. As a result of exposure to HPEMP and subsequent comminution, selective opening of mineral aggregates, a decrease in the number of aggregates with a low sulfides content (up to 10 %) and increase in the number of aggregates with a predominant content (70 – 90 %) of sulfides occurred. At a short-term HPEMP treatment (t_{treat} = 30 s), the extraction of nickel into the froth product of flotation increased by ~ 4 %. Thus, the advantages of using the short-term (t_{treat} = 10 – 30 s) pulse energy impacts for structural, physicochemical and technological properties of iron, copper, and nickel sulfides are shown.

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Influence of Anthropogenic Raw Materials on Physical and Mechanical Properties of Organic-mineral Compositions

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Improving the durability of roads and reducing the operating costs of their maintenance is always relevant. Road construction is the most material-intensive area for the use of non-metallic building materials. In this industry, there is an urgent question both about improving the quality of the

structural layers of the road surface, and about replacing natural materials, especially imported from other regions, with local, cheaper raw materials and, first of all, with waste from the mining industry. Asphalt concrete is an organic mineral composition of mineral powder, stone materials and an organic binder, namely bitumen or tar. Asphalt concrete in road clothes works independently, performs the role of the main load-bearing layer of the structure when exposed to dynamic loads. It is possible to obtain high-quality asphalt concrete composites only when creating an optimal structure between organic binder and mineral components, which is determined by physical, physicochemical and mechanical interactions at the interface of phases. This report presents studies of the effect on the properties of asphalt concrete compositions of stone materials (crushed stone) from the burnt rocks of mine dumps, and mineral powder (finely ground burnt rocks and fly ash) waste from coal burning. For asphalt concrete composites on materials from burnt rocks, high values of strength, water resistance, frost resistance were revealed (see Figs. 1, 2) and low values for water saturation. The absence of clay impurities on the surface of aggregates from burnt rocks ensures good adhesion of the grains of such filler with organic binder. The bitumen film is denser and less susceptible to aging from external influences, than the bitumen film on the surface of a traditional filler. Due to the presence of active components with free energy and capable of showing pozzolan activity, aggregates from burnt rocks independently form a monolith and influence additional strengthening of the material structure, manifested over time, after reaching the design strength.

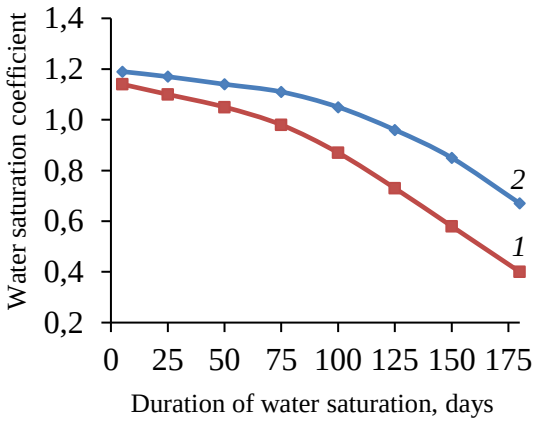

Fig. 1. Change of water resistance coefficient for asphalt concrete with prolonged water saturation: 1 – type B; 2 – type G.

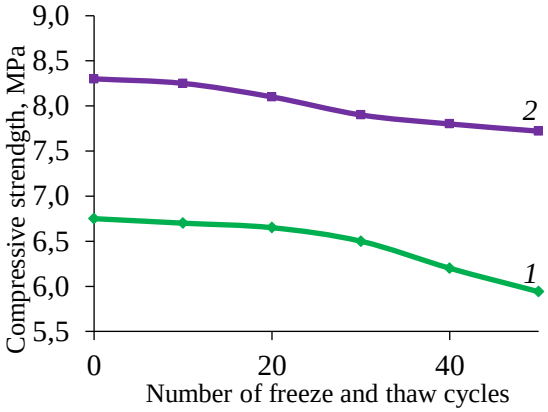

Fig. 2. Change in the strength of asphalt concrete from test on frost resistance: 1 – type B; 2 – type G.

Acknowledgement. The study was carried out with the financial support of the Ministry of Science and Higher Education of the Russian Federation (State task in the field of scientific activity, scientific project No. FENW-2023-0012).

On the Relationship between the Properties of Technogenic Raw Materials and the Quality of Fine-grained Concrete Based on Them

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Ash and slag materials and burnt rocks have a positive effect on the properties and quality of concrete products based on them. So, paving slabs have a concrete class in compressive strength B30 – B50, in frost resistance F400 with virtually no reduction in strength when tested for frost resistance. The best indicators of physical and mechanical properties were obtained for

compositions, containing both ash and burnt rock in the form of crushing screenings. Ash and slag materials and burnt rocks, by virtue of their origin, have active components in their composition that can interact with cement hydration products and form an additional amount of calcium hydrosiltates of various basicity. When they are in the system together, the mechanism of their action in the concrete mixture is enhanced (synergistic effect). Concretes containing technogenic raw materials (ash and slag waste or burnt mine rocks) have high bending strength. Figure 1 shows the dependence of bending strength on compressive strength for three types of concretes: ash concrete (curve 1), burnt concrete (curve 2) and concrete on traditional materials (curve 3 – control). The ash concrete has highest values of flexural strength, and the conventional concrete has lowest values. The increased strength of ash concrete is associated with a pronounced plasticizing effect of ash, which contributes to the formation of a more homogeneous and dense structure of concrete. The positive influence of ash and slag materials and burnt rocks on the physical and mechanical properties of concrete, as well as the emerging opportunity to significantly reduce cement consumption (up to 45 %) without deterioration of the properties and quality of concrete, give reason to recommend them for wide use in concrete technology. According to the obtained indicators of strength, frost resistance, abrasion resistance, corrosion resistance, resistance to alternating moistening and drying and other properties, these concretes can be recommended for the production of paving slabs, side stones, facing slabs, artificial paving stones, concrete tiles and other small-piece concrete products.

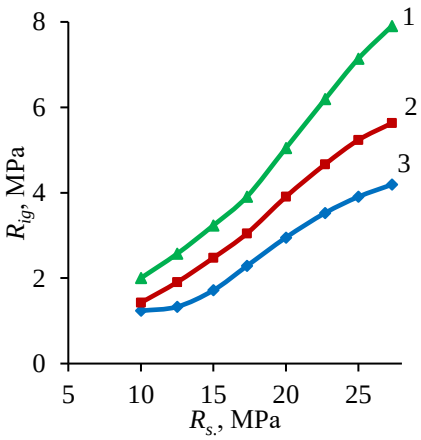

Fig. 1. Concrete compression strength dependence: 1 – ash concrete; 2 – burnt rock concrete; 3 – normal concrete (control).

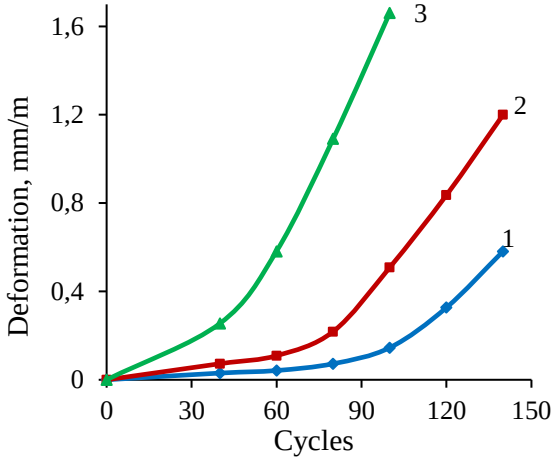

Fig. 2. Kinetics of the development of linear strains of concrete during cyclic tests in a solution of Na_2SO_4: 1 – composition with the addition of rocks; 2 – composition with the addition of ash; 3 – control composition.

Acknowledgement. The study was carried out with the financial support of the Ministry of Science and Higher Education of the Russian Federation (State task in the field of scientific activity, scientific project No. FENW-2023-0012).

Legal Certainty of Biography Museum

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Indonesia is a cultural heritage that has a rich local wisdom of nature and history, especially in this case, history is what should be valued by the Indonesian people such as the museum in Indonesia.

Museum has a function, among others, as a place to manage the results of natural cultural heritage. Museums in Indonesia are appreciated by the people of Indonesia. For example, the Wr. Supartman museum in Surabaya, it is proven that the Surabaya city government manages the place to become a museum to commemorate an inspiring figure of Indonesia, namely Wr. Supartman. Museum in Indonesia has the application aims to make the value of cultural values in and heritage objects that have historical value so as not to fade from people's lives. So, in this case the museum must be in accordance with the legal certainty regulated in this matter. Museums in Indonesia must be in accordance with the government, so the museum is a place that is in accordance with its legal certainty with various points of these provisions can get maximum results. With the museum, people can change their mindset in terms of aspirations for the museum. Because the museum is a cultural heritage relic that does not escape its historical value. Items and objects in the museum are heritage in the museum. So, the community can appreciate and manage the museum. With various ways to promote the museum, many people will appreciate and get to know the Wr. Supratman museum.

Feature Extraction of Marine Mammals Vocalizations Based on Marginal Frequency Relative Entropy of Intrinsic Mode Functions

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Empirical Mode Decomposition (EMD) [1] is a signal-processing technique used to analyze nonlinear and non-stationary data. EMD decomposes a signal into a set of intrinsic mode functions (IMFs) using a data-driven approach, without requiring prior knowledge of the signal's characteristics. The interpretation of IMFs requires careful analysis and domain knowledge of the specific application to identify the IMF(s) containing relevant signal components. For example, an IMF with the lowest frequency content may correspond to noise or low-frequency noise-like components, whereas the IMF with the highest specific energy ratio may correspond to the desired signal [2, 3]. Relative entropy (RE), also known as the Kullback-Leibler divergence [4], is a metric that evaluates the dissimilarity between two probability distributions. This over measures the amount of information lost, when approximating one distribution over another. The relative entropy D_{KL} between the two distributions P_{IMFi} andP_{IMFi+1} can be expressed as:

$$D_{KLi}(P_{IMFi}||P_{IMFi+1}) = \sum_{x\in X} P_{IMFi}(x)\, log\, \frac{P_{IMFi}(x)}{P_{IMFi+1}(x)} \quad (1)$$

Here, P_{IMFi} and P_{IMFi+1} refer to the probabilities of the i-th and (i+1)-th IMF in the marginal frequency distribution. The relative entropy is always non-negative and is equal to zero only when P_{IMFi} and P_{IMFi+1} are identical distributions, a larger relative entropy, indicates a greater difference between the distributions P_{IMFi} and P_{IMFi+1}. The results are presented in Fig. 1 and Table 1. Observing that D_{KL1} ~ D_{KL4} values are relatively large, and values after D_{KL5} tend towards zero, it was determined that the desired signal mostly falls within the first four IMFs, which are defined as competent IMFs (CIMF).

Table 1. Signal extraction parameters with MF/max freq. (the frequency of the highest energy ratio) and D_{KLi}

	IMF1	IMF2	IMF3	IMF4	IMF5	IMF6	IMF7	IMF8
MF/max freq.	40	27	14	13	5	2	1	1
D_{KLi}	5.17	19.11	24.7	23.55	3.5	1.65	0.45	0.06

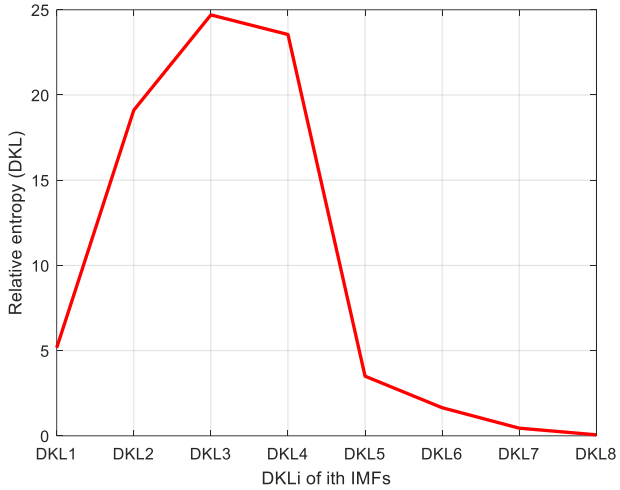

Fig. 1. Relative entropy of adjacent IMFs with $D_{KL1} \sim D_{KL8}$

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Integrated Circuit Testing Engineer Competency Accreditation System to Shorten the Gap between Learning and Field

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An Integrated Circuit Testing Engineer Competency Accreditation System has been set up and obtained official certification. This system can shorten the gap between learning and field, and also shorten the training time for newcomers in the company. Manufacturing a semiconductor device involves many complex process steps [1, 2]. Firstly, based on the customer's requirements, integrated circuits are designed using IC EDA tools. These circuits are then transformed into layout graphics on a semiconductor wafer. The waferundergoes processes such as photolithography, etching, and diffusion to produce the actual circuit design on the semiconductor wafer. The

produced wafer is then subjected to testing of its parameters and functionality. The Circuit Probe (CP) stage, also known as wafer sorting, is primarily designed to test the circuit design functionality of each naked chip in every wafer before packaging. If a chip is substandard, a small dot of ink is marked on it. After all the dies on the wafer are tested, the yield ratio of good and bad products on that wafer is calculated. Based on the yield rate of the wafer, the semiconductor process can be improved, and it can be decided whether to enter the next stage of packaging process. This is done to improve the yield of the previous process and reduce the cost of packaging production. The wafer is then cut into individual dies. Good dies are packaged according to the IC product application specifications. The Final Testing (FT) stage is designed to test the functionality of the IC product, including its circuit function, speed, environmental durability, and power consumption, ensuring the quality ofthe IC before shipment. The semiconductor testing process in the Semiconductor Testing Factory is shown in Fig. 1. The Integrated Circuit Testing Engineer Competency Accreditation System proposed in this project, aimed at improving the production technology and management level of the workforce in semiconductor testing factory. The system consists of three main programs:

(i) we built the first "semiconductor packaging and testing production line" on campus in Taiwan, which simulates the real industrial environment and equipment to allow trainees to familiarize themselves with the semiconductor testing factory's operational process in school;

(ii) offer a range of credit courses for semiconductor testing, which provides training courses on basic measurement theory and practical techniques, allowing trainees to apply what they have learned in industry internships;

(iii) set up the certification system for semiconductor testing engineer examination, which uses standardized testing procedures to achieve the goal of integrating technical and vocational education.

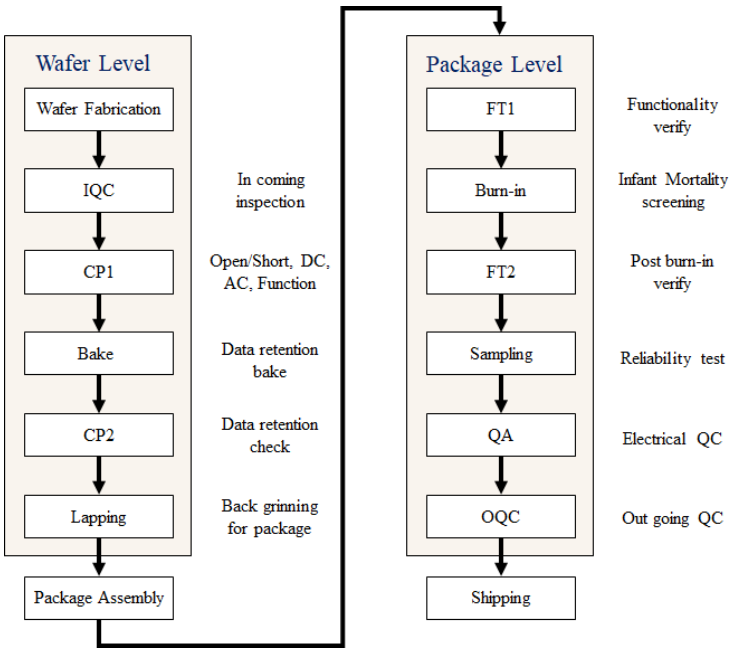

Fig. 1. Semiconductor testing process in the semiconductor testing factory

The Automatic Testing Equipment (ATE), which we used, is shown in Fig. 2. The Industrial Bureau of the Ministry of Economic Affairs of Taiwan clearly lists our base as a qualification unit for semiconductor professionals. Through this system, trainees can learn in a real semiconductor testing factory environment andgain rich practical experience, while also being able to prove their skills and knowledge through certification. The implementation of this system can improve the efficiency and production quality of semiconductor testing factories and promote the development of technical vocational education. This program has been implemented in several universities of science and technology in Taiwan and has trained many students with the ability of a

semiconductor testing engineer. After the training period, they can directly enter the workplace for industrial use and have contributed outstanding results. This system has been proven that can shorten the training time from 6 months to 3 months for newcomers in the company. Therefore, Taiwan has established its position as the world's first in semiconductor wafer foundry and packaging and testing.

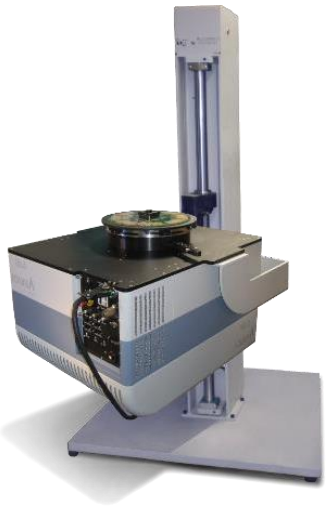

Fig. 2. Automatic testing equipment (V101) with test head and manipulator

Acknowledgement. This work is supported by the Semiconductor Industry Talent CultivationBase of Minghsin University of Science and Technology, and JTRON Technology Corporation.

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Development of Food Recipes in Semaring Regional General Hospital

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There are two main factors that cause food waste in hospital patients, namely internal and external factors. Internal patient factors, namely clinical conditions such as appetite, changes in the sense of taste, dysphagia, stress and length of treatment. Meanwhile, external patient factors include food portions, food quality, menu choices or variations, food appearance, staff attitudes, food delivery errors, meal schedule discrepancies, and the atmosphere of the treatment area. High food waste is a serious problem that must be addressed immediately because the food, served by the hospital, has calculated the quantity and quality according to the patient's needs. Therefore, all the food served must be consumed by the patient in order to achieve the success of organizing food at the hospital. Taste consists of the appearance of food and the taste of food. The appearance of the food served is the appearance of the food, which includes the color, shape of the food, portion size and method of serving. The taste, evoked by food, is the result of the work of taste buds, located on the tongue, cheeks, esophagus, roof of the mouth and includes the aroma of food, seasonings, degree of maturity, temperature and texture of food. Recipe development is an effort to improve the taste, color, aroma, texture, and nutritional value of food to make it more quality and attractive (increase acceptability) and to add variety to the menu of institutions. Research in Dr. Sarjito Hospital showed that the average percentage of leftovers was found at breakfast and was found equal to 25.35 % in vegetables, 23.1 % in rice, and 22.93 % in vegetable side dishes. At dinner time, the most leftovers were found

equal to 22.93 % in vegetables, and 21.86 % in vegetable side dishes. In line with the results of research at the Godangrejo Health Center, this type of research is a pre-experimental study using a one-group pretest-posttest design to describe the results of assessing the taste and residue of vegetable dishes before (original recipe from the hospital) and after developing the recipe. First observation (pretest) assessed acceptance respondents to the initial recipe, then the researcher tested the changes that occurred after the experiment (recipe development). The samples in this study were all of class III patients at the Semarang City Hospital, who received regular food during the study in July 2015. The collected data provided sample identity, food waste data, food taste, initial food recipe and food recipe after recipe development. Data analysis used the Wilcoxon Test to test the hypothesis of two paired samples with an ordinal scale. The samples used were of class III patients: at the Semarang City General Hospital (36 patients); from the Srikandi room (7 patients); from Dewi Kunti room (18 patients); from Prabu Kresna room (7 patients) and Parikesit room (4 patients). There are differences in nutritional needs for each age. The older the human age, the less energy and nutrient needs. Gender can be a factor, affecting the acceptability of food, because the nutritional needs of men and women are different. Education in general is any effort that is planned to influence other people, whether individuals, groups or communities so that they do what is expected by the perpetrators of education. It is known that most of the samples had high school education (58.3 %), the rest had elementary school education (5.6%), junior high school (27.8 %), and PT (8.3 %). The development of the recipe consisted of change the main seasoning recipe from coconut milk food, namely carrot chickpea curry to Gudangan. The patient's taste assessment before developing the recipe was that majority of the samples (97.2 %) stated that they were satisfied with the taste of curry food and the taste assessment by the patients after the recipe development was that majority of the samples (95.8 %) also stated that they were satisfied with the taste warehouse. The remaining food of the patients prior to developing the recipe was that majority of the samples (94 %) left a small amount of curry. The rest of the patient's diet after developing the recipe was majority of the samples (72 %), leaving a small amount of storage. So, it can be seen, that the rest of the warehouse is more than the carrot chickpea curry. There is no difference in the taste of food before and after developing the recipe. This is based on the Wilcoxon test which has been carried out showing a P Value > 0.05, namely a portion size of 0.32; food color by 1.00; food serving of 0.66; food taste of 0.66; food aroma of 1.00; food seasonings of 0.74; food maturity of 0.37; and food texture of 0.08. There is a difference between leftovers before recipe development and after recipe development. This is based on the Wilcoxon test, which has been carried out showing a P Value < 0.05, which is equal to 0.007.

Investment In Tailor Village

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Krisna Tailors are Small and Medium Enterprises (SMEs) that provide kebaya-making services and always prioritize the quality of the products they make. This Krisna tailor is located in the Bulalada Office Banjar, Selat Village, Sukasada District, which is in front of the Bululada Office Banjar Hall. With this strategic location, it allows easier for consumers to reach that place. The quality of the good and neat sewing of the kebaya makes its customers feel satisfied after using their services, so that customers recommend Krisna Tailors to their relatives to take part in using the services of Krisna Tailors. This made the business, which they started, continues to grow and becomes known by many people. Not only kebaya sewing services, Krisna Tailor also provide unfinished kebaya fabrics such as brocade, embroidery and so on. With this, it makes easier for consumers to shop and use their services at the same time. Moreover, it improves the following: (i) quality of service to customer satisfaction Krisna Tailors in Singaraja; (ii) product quality on

consumer satisfaction at Krisna Tailors in Singaraja; (iii) quality of service to customer loyalty Krisna tailors in Singaraja; (iv) product quality on customer loyalty at Krisna Tailors in Singaraja; (v) consumer satisfaction on customer loyalty at Krisna Tailors in Singaraja; (vi) service quality through customer satisfaction on customer loyalty at Krisna Tailors in Singaraja; (vii) product quality through customer satisfaction on customer loyalty at Krisna Tailors in Singaraja. This research seeks to obtain data relating to the practice of providing kebaya-making services and always prioritizing the quality of products by tailors at Banjar Dinas Bulalada, Selat Village, Sukasada District during this pandemic to improve their economic level. Based on the results of this research, it is suggested to tailors in the village to be able to maintain the business that was built several years ago. Then can increase creativity and innovation so that customers will continue to grow and still maintain the strategies that have been carried out from the start of opening a tailoring business.

Contact Interaction of the Stamp and the Elastic Base with Liquid-filled Pores

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Poroelasticity theory studies the stress-strain state of elastic bodies with a porous structure. Such tasks are widespread in geomechanics, for example, in the development of hydrocarbon deposits, as well as in biomechanics in the study of bone tissue. In addition, pores can also be considered as defects in the material that occur during its manufacture. They can have a significant impact on the strength properties of the material and the performance characteristics of the mechanisms in the production of which such materials are used. In the present report, a study of the stress-strain state of a poroelastic base with fluid-filled pores is carried out. The static flat contact problem of pressing a rigid stamp into such a base is considered. The study was carried out within the framework of the model of an ideal incompressible fluid. To solve this problem, the finite element method and the ANSYS software package were used. Special hydrostatic elements HSFLD241 were used in the simulation. They are intended to describe a closed volume of a liquid medium, bounded by a solid. With their help, it is possible to take into account the presence of a liquid of a certain mass, as well as the change or immutability of its volume during deformation. Two cases were considered: (i) a base with a defect in the form of a pore, filled with liquid, and (ii) a base with a large number of pores, evenly distributed over the area. For the first case, the influence of the size of the defect, its position relative to the contact zone, as well as the density of the liquid on the contact pressure and deformation of the base is studied. It is shown that the presence of a defect in the vicinity of the contact area leads to an increase in contact pressure and stresses at the defect boundary, which can contribute to the formation of cracks and subsequent destruction. For the second case, the stress-strain state is calculated for different pore pressure values, the number and size of pores. Estimated comparisons of simulation results for small values of liquid density and pore pressure with numerical calculations for a poroelastic base with hollow pores are carried out. It is established that with the same geometric parameters and loading with a decrease in fluid density and pore pressure, the values of deformations and stresses tend to the values calculated for the case of hollow pores.

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Contact Problem for a Poroelastic Strip Laying on a Winkler Base

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The ground base is usually represented by some mechanical model. One such model is the Winkler model. The main assumption of this model is a directly proportional relation between the base reaction and the vertical displacement of its surface. The Winkler model can be interpreted as a continuous set of springs on which the structure is based. Various elastic and poroelastic models can be used as other models of the ground base. Poroelastic materials have unique physical and mechanical properties. This type of material has found wide application in various fields of human activity due to the optimal correlation of mass and strength. One of the modeling approaches of the porous materials was developed in the Cowin-Nunziato works. This theory, called the microdilation theory, has been applied to the study of porous materials with empty pores. The calculation of structures interaction with this type of bases or their combinations is of practical interest. The plane problem of the interaction of a rigid stamp with a poroelastic strip, lying on a Winkler base, is considered in the work. On the base of the equations of the theory of poroelastic bodies of Cowin-Nunziato, the deformation of the strip is modeled. It is assumed that the base of the stamp has a flat or parabolic shape, there is no friction in the contact zone. With the help of the Fourier integral transformation, the posed problems are reduced to an integral equation for an unknown contact stress, which is solved with the use of the collocation method and the asymptotic method. The values of contact stresses, sizes of the contact area in the case of a parabolic stamp and the relative deformation of the surface outside the stamp are found. A comparative analysis of the studied quantities for various values of the poroelastic strip parameters and the coefficient of subgrade resistance of the Winkler base have been carried out. Numerical results are presented in the form of tables and graphs.

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Methodology of Determination of Porosity Parameters in the Theory of Microdilation

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At present time porous materials are actively used in many branches of industry, construction, and medicine. There are two ways to model bodies with voids: to use the geometry of such bodies with pores of the desired shape, size, and numbers or to consider bodies without explicit voids, the deformation of which is described by differential equations of a special form. Kowin and Nunziato developed the micro-dilatation theory, which makes possible to effectively investigate various problems of poroelastic bodies, containing unfilled voids, on the base of analytical approaches.

The micro-dilatation theory is based on a system of differential equations, which contains several parameters, the values of which are not available in reference books, that limits the using of this theory in practice. Some publications offer schemes of determination of these parameters. In this report, we propose a methodology of determination two of such important parameters of the micro-dilation theory, namely porosity changing stress parameter and void stiffness coefficient, taking into account the voids distribution density. To determine the values of these parameters, a scheme has been developed on the base of a comparison of plane contact problems solutions for an elastic body, containing unfilled voids in the form of circles with different distribution density and for the corresponding body, the deformation of which is described by the micro-dilatation theory. The first problem is solved, using the finite element method, the second problem is based on the analytical approach to solving the resulting integral equation. The control of the accuracy of the obtained parameter values was carried out by comparing the results of solving similar contact problems with other base forms of stamps.

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The Behavior of Dielectric Properties in the Solid Solutions Based on $Na_{0.5}Bi_{0.5}TiO_3$ and $Na_{0.5}K_{0.5}NbO_3$

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Dielectrics with high-energy storage density, low losses and good temperature stability are in demand in modern electric power. Compounds, based on lead zirconate-titanate (PZT), are popular because of excellent electrophysical parameters and widely using in industry. The main disadvantage of lead-containing materials is toxicity. Therefore, it is necessary to create lead-free analogues. Promising analogues are materials, based on sodium bismuth titanate and niobates of alkali metals. They have high dielectric permittivity and increased breakdown strength. Varying the composition of solid solutions makes it possible to expand the range of use and improve the properties of the material. The aim of this study is to establish the regularity between phase formation, structure, and dielectric properties of solid solutions, based on $Na_{0.5}Bi_{0.5}TiO_3$ and $Na_{0.5}K_{0.5}NbO_3$ systems. The subjects of research were solid solutions of the system $(1 - x)Na_{0.5}K_{0.5}NbO_3 - xNa_{0.5}Bi_{0.5}TiO_3$, where $0.0 \leq x \leq 1.0$, $\Delta x = 0.1$. The production was carried out by the two-step solid-phase synthesis under the conditions: T_{syn1} = (850 – 950) °C, T_{syn2} = (850 – 970)°C, $t_{syn1} = t_{syn2}$ = 4 h, $T_{sintering}$ = (1125 – 1150) °C , $t_{sintering}$ = 2 h. The purity and formation of perovskite phase in products were monitored by powder X-ray diffraction using CoKα radiation. Dielectric hysteresis loops were obtained using a measuring set-up, assembled according to the Sawyer-Tower scheme at room temperature. The energy density was obtained from the curves of the dependence of polarization on the electric field ($P - E$) by integrating the area between the axis of polarization and the curve $P - E$. With the help of integration, the values of effective energy and efficiency were calculated. The stored energy density, W_{eff}, was calculated by the formula: $W_{\text{eff}} = \int_{P_r}^{P_{\max}} E\mathrm{d}P$, where P_{max} is the polarization value at maximum E, P_r is the value at $E = 0$. The values of η, the efficiency, were calculated by the formula: $\eta = \frac{W_{\text{eff}}}{W_{max}} \cdot 100\%$. X-ray diffraction

showed that the solid solutions of the system $(1 - x)Na_{0.5}K_{0.5}NbO_3 - xNa_{0.5}Bi_{0.5}TiO_3$ does not contain impurities. The system undergoes morphotropic phase transitions: monoclinic ($x = 0.0$) → tetragonal ($x = 0.1$) → pseudocubic ($x \geq 0.2$) → rhombohedral ($x = 1.0$). The best properties in terms of energy storage are shown by solid solutions with $x \geq 0.7$. The energy density and efficiency increase with an increase of x: $W_{eff} = 31.23$ J/cm^3, $\eta = 12.69$ %, at $x = 0.7$; $W_{eff} = 68.70$ J/cm^3, $\eta = 46.34$ %, at $x = 0.8$; $W_{eff} = 28.00$ J/cm^3, $\eta = 76.68$ %, at $x = 0.9$. However, at $x = 1.0$ (when there is only $Na_{0.5}Bi_{0.5}TiO_3$ in the system), the energy density decreases again. The maximum value of the energy density in this case $W_{eff} = 20.74$ J/cm^3 is observed at 1900 V, with efficiency $\eta = 51.88$ %. These data is advisable to use in the development of new materials for energy storage devices.

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Using Subcritical Growth Modes to Form InAs Quantum Dots on Patterned GaAs (100) Substrates

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Active elements of integrated nanophonics, quantum communication and quantum computing systems being developed today are based on quantum dots (QDs) due to their unique properties. Therefore, an urgent task is to control the position, size, and shape of quantum dots, both single and in an array. For these purposes, one of the most promising approaches is based on the preliminary structuring (patterning) of substrate. In this work, we study the influence of the methods of nanoholes formation, their sizes, and shapes on the formation of nanostructures in them, as well as the possibility of obtaining QDs at subcritical thicknesses and without a wetting layer. The formation of nanoholes was carried out by two methods: local droplet etching (LDE) and modified oxide desorption. After the stage of surface nanostructuring, an InAs layer with a thickness from 0.1 to 1.5 monolayers (ML) was grown. The same heterostructure was also grown with a layer of InAs (1.5 ML) without a nanostructured surface, which we used as a reference sample. To study photoluminescence (PL), we repeated the same structures by placing them in the central part of the AlGaAs/GaAs/AlGaAs heterostructure. The research results showed that the choice of method directly affects the geometric parameters of the obtained nanoholes. They affect not only the selectivity of nucleation processes, but also the type of growing nanostructures, as well as their optical properties. After LDE, nanostructures about 1 – 2 nm high and 150 – 200 nm in diameter are formed on the sample surface, which is much larger than the previously formed nanoholes. In case of oxide desorption patterning, QDs with a height of about 3 nm are formed on the surface, the size of which correlates nonlinearly with the size of the initial nanoholes. However, due to the high roughness after oxide desorption, many small QDs are also present on the surface. An analysis of the PL spectra shows that the InAs nanostructures are optically inactive when LDE is used. We attribute this to the fact that, due to their large size, many defects are formed in them. In the case of oxide desorption patterning, the PL spectra contain a set of separate QD lines in the range of 1000 – 1150 nm, while the wetting layer line is absent, which indicates a complete redistribution of the deposited material between QDs.

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Ammonia Conversion Process Automation System

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Ammonia (NH_3) is a chemical compound, composed of nitrogen and hydrogen. Ammonia is one of the most important industrial chemicals, used in many industries such as agriculture, fertilizer production, refrigeration systems and plastics production [1]. Ammonia production is a complex and energy intensive process that requires a lot of energy and resources. Recently, new production methods for ammonia have been developed, such as the ultrasonic method, which can reduce energy and resource consumption [2]. Ammonia conversion is an important industrial process, used to produce nitrogen fertilizers. In this process, ammonia, obtained from gas through gas synthesis, is oxidized to nitric oxides, which are then converted to nitric acid [3]. The ammonia conversion process automation system is a modern solution for the production of fertilizers and chemical compounds. This system allows one to significantly increase the efficiency of the ammonia conversion process, minimize the risk of errors and reduce production costs. The main components of the automation system are the controllers that control the conversion process. Controllers make it possible to automate not only the control of process parameters, but also to regulate the operating parameters, such as pressure, temperature, and flow rate of a substance [4]. The automation system also includes a monitoring system that allows operators to control the conversion process on a remote computer or mobile device. The system interface allows the operator to receive information about the current state of the process, as well as notify about possible problems and their solutions. By using the ammonia conversion process automation system, high levels of productivity can be achieved, and the commissioning time of new plants can be greatly reduced. In addition, the system allows one to minimize the risks of injuries and errors from the human factor. Thus, the ammonia conversion technological process automation system is an advanced solution that contributes to the improvement of production processes and production efficiency [5].

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Study of Axial T-shaped Piezoelectric Generator

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Into framework of scientific research, a finite element model was developed based on the ANSYS software [1, 2]. An experimental testing of a piezoelectric generator (PEG) with proof mass and an active base has been carried out. The piezoelectric generator consisted of active and passive construction elements. The active element includes piezoelectric cylinders and piezoelectric plates. An optimization can be performed in both parts of PEG. Most researchers try to optimize the active region by changing the length, thickness, position of the piezoelectric element, etc. However, the output power of the energy harvester also depends on the passive part of the generator, the beam capacitance, the electrical load resistance, the first natural frequency, the proof mass parameters and its location, the input excitement and PEG base. In this report, we optimize numerically the passive part of the T-generator plate, which consists of the duralumin base plate, and the proof mass. We optimize: (i) the various positions of proof mass on duralumin base plate; (ii) the length of duralumin base plate and proof mass, attached at the end point; (iii) the fixation of proof mass and length of the duralumin base plate; (iv) the acceleration effect of applied vibration; (v) the length of the duralumin base plate without proof mass. As a part of the study, the most optimal results were obtained and a cumulative analysis of the PEG output characteristics was performed.
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Automation of the Natural Gas Heating Section

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The heating of natural gas is a process that takes place before the gas is transported in gas pipelines. The gas extracted from the earth has a low temperature. For safe and efficient transportation, it is

necessary to heat natural gas to a temperature that is suitable for transportation, thereby reducing the risk of gas freezing in pipes [1]. There are several methods for heating natural gas. One of the most common methods is the process of gas injection through a heating unit, which heats the gas with the help of a heat exchanger [2]. Another method is to use the heat, generated by a gas turbine, by which the gas is compressed and heated during the compression process. The automation system for the natural gas heating section is a necessary component of the gas treatment process before its transportation and using in various technological processes [3]. The purpose of automation is to ensure the stability of the gas temperature at the desired level in accordance with the requirements of the process and ensure the safety of personnel. The natural gas heating site automation system consists of several components. One of them is a temperature controller that monitors the gas temperature and regulates it with the help of thermal elements, located along the gas heating section. The system also uses pressure sensors that control the degree of gas treatment and prevent various emergencies. An important component of the system is a programmable logic controller that controls the operation of all components and communicates with other systems, providing a unified coordination of all processes [4]. The automation system for the natural gas heating section is a key part of the gas treatment process and allows one to increase production efficiency, reduce the risk of accidents and ensure a high level of safety for personnel [5].

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Reactor Automation System for Selective Purification of Process Gases

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A selective gas purification reactor is a device that is used to remove certain components from a gas mixture. This makes it possible to significantly improve the quality of the outgoing gas, reduce the content of harmful impurities in it, and minimize the harmful effect on the environment [1]. The principle of operation of the selective gas purification reactor is based on the use of special

sorbents, namely substances that can select only certain components from the gas mixture. Sorbents are often nanoparticles, which can be metallic, oxide, or carboxylic [2]. The main goals of automating the reactor for the selective purification of process gases are to improve the quality of purification, increase the speed and accuracy of this process, as well as reduce the cost of its implementation. The automation system includes the following components [3: (i) *reactor*, consisting of cylindrical stainless steel with extension cones; the reactor is equipped with appropriate replaceable catalytic fillers, which are used for cleaning process gases [4]; (ii) *flow meter*, that determines the gas flow in the system and transmits the relevant information to the controller; (iii) *thermocouple*, used to control the temperature in the reactor; (iv) *controller*, that provides automatic control of the system, based on information, received from the flow meter and thermocouple; (v) *nitrogen flow meter*, used to determine the flow rate of nitrogen, required to create the necessary conditions in the reactor; (vi) *pressure regulator*, that regulates the nitrogen pressure in the reactor; (vii) *gateway block*, used to supply and exhaust gases in the system. The process gas enters the reactor, where the selective purification process takes place. The process setting is carried out automatically by the controller, which receives information about the gas flow and temperature in the reactor. After cleaning, the gas is released from the system through the sluice block [5]. The automation system of the reactor for selective purification of process gases is an important task that helps to improve the quality of the production process and increase the efficiency of its implementation.

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Research of Hydrophones with Zinc Oxide Nanopillars and Seed Layers Grown on Three Types of Substrates

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The paper studies efficiency of sound receiving for hydrophones based on different seed layers like Zinc Oxide or Zinc Oxide Aluminum with Zinc Oxide nanopillars on Fluorine Tin Oxide (FTO), Indium Tin Oxide (ITO) and Sapphire substrates. There are six constructions in the study: (i) ITO substrate with Zinc Oxide Aluminum seed layer, (ii) ITO substrate with Zinc Oxide seed layer, (iii) FTO substrate with Zinc Oxide Aluminum seed layer, (iv) FTO substrate with Zinc Oxide seed layer, (v) Sapphire substrate with Zinc Oxide Aluminum seed layer, (vi) Sapphire substrate with Zinc Oxide seed layer. We manufacture hydrophones by six processes: cleaning and drying substrate, sputtering Zinc Oxide or Zinc Oxide Aluminum seed layers by using magnetron sputter system, annealing seed layers on FTO, ITO and Sapphire substrates, making Zinc Oxide nanopillars by Hydrothermal method, making Aluminum interdigitated electrodes and silicon dioxide protective layer by sputtering, filling curved glass with oil and heating curved glass under the sample, welding wire and packing the waterproof with epoxy. After finishing these processes, we put the hydrophones into water and measure the sound receiving efficiency by hydrophone volume measurement system.

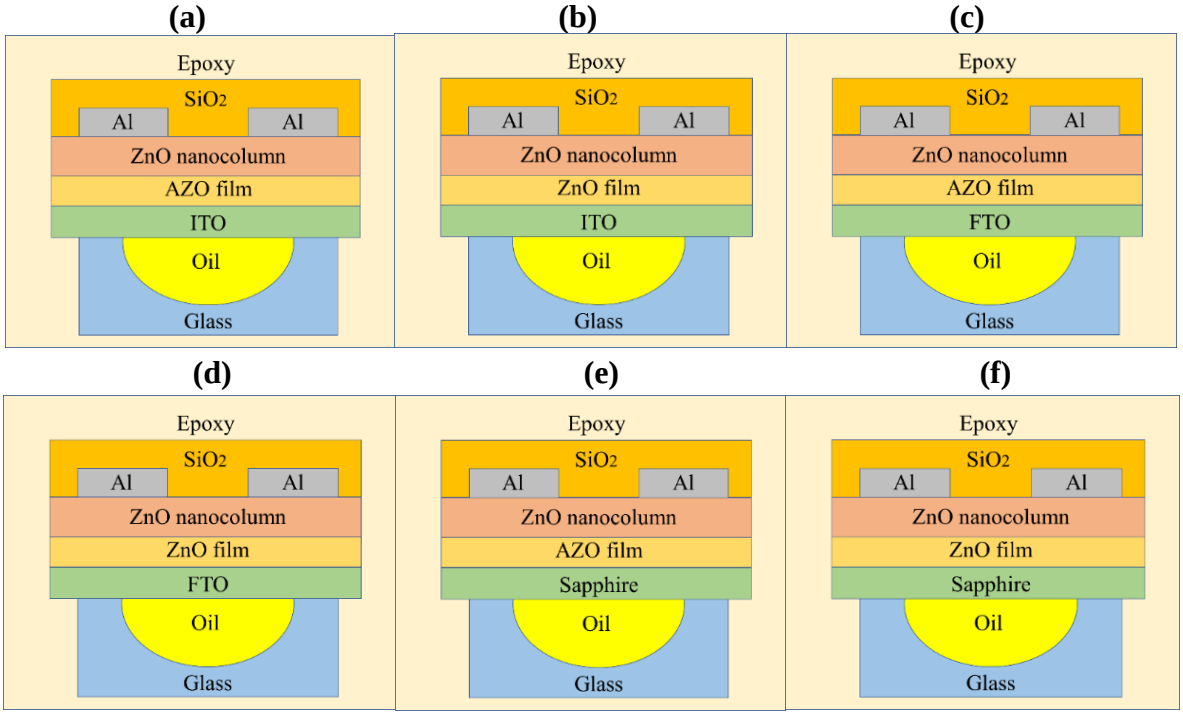

Fig. 1. (a) ITO substrate with Zinc Oxide Aluminum seed layer (b) ITO substrate with Zinc Oxide seed layer (c) FTO substrate with Zinc Oxide Aluminum seed layer (d) FTO substrate with Zinc Oxide seed layer (e) Sapphire substrate with Zinc Oxide Aluminum seed layer (f) Sapphire substrate with Zinc Oxide seed layer.

Effective Passivation of *n*-GaAs Surface with the Sulfide-based Solution

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In recent years, the application of III-V compounds such as GaAs has become very popular. Its direct wide bandgap and high electron mobility make it suitable for use in microelectronics and optoelectronics devices. However, the native oxide of GaAs induces a high surface state density, leading to strong Fermi-level pinning near the center of the bandgap. As a result, removing the native oxide is a major point in GaAs research. This paper compares the passivation effects of $(NH_4)_2S$ + H_2O solution and $(NH_4)_2S$ + Se + *t*-C_4H_9OH solution on *n*-GaAs substrates. The reactivity of sulfides increases exponentially due to the electrostatic interaction between sulfide ions and the semiconductor. The passivation effect of the solution increases with a lower dielectric constant. Results from Auger electron spectroscopy demonstrated superior passivation effects for samples treated with the $(NH_4)_2S$ + Se + *t*-C_4H_9OH solution. In Ga 3d binding energy, the intensity ratio of GaO/GaAs are 0.157 and 0.0745, corresponding to samples with $(NH_4)_2S$ + H_2O and $(NH_4)_2S$ + Se + *t*-C_4H_9OH treatments, respectively. It indicates that native oxides are much reduced in $(NH_4)_2S$ + Se + *t*-C_4H_9OH compared with $(NH_4)_2S$ + H_2O treatment. Therefore, the *n*-GaAs with $(NH_4)_2S$ + Se + *t*-C_4H_9OH treatment can be expected to have good surface and electrical properties and be applied to advanced optoelectronic devices.

The Influence of Doping by Sn (II) Cations on Antimony Sulphoiodide Semiconducting Properties

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The ternary V^A-VI^A-VII^A - type materials attract considerable scientific interest due to unusually large number of interesting properties. They display semiconducting, piezoelectric, pyroelectric, electrooptic and photoelectric effects. Among them antimony sulphoiodide (SbSI) has a high photoelectric sensitivity and a bandgap suitable for solar energy adsorption [1]. These desirable properties make the compound a promising photoelectric material. The introduction of Sn (II) dopant into SbSI structure leads to Curie point increase of material obtained [2]. The investigation of this doping effect on the bandgap width is of considerable interest. The SbSI:xSn samples were obtained using synthesis in water solution [2] and were characterized with UV–vis spectroscopy technique. Absorption maxima of the samples are in a visible region of 500 – 600 nm. The band gap was estimated using the equation: $(\alpha h\nu)^n = A(h\nu - E_g)$, where A is an empirical constant, α is an absorption coefficient, and n = 1/2 for an indirect interband transition for SbSI [3]. The band gap value varies within 1.97 – 1.99 eV with an increase of dopant content from 1 to 10 mol%.

These values are more than indirect forbidden energy gap of undoped SbSI, which is equal to 1.85 eV according to [3]. Hence, the doping of antimony sulphoiodide by Sn(II) cations leads to the bandgap increase of material obtained. Thus, it could be concluded that, the tin-doped antimony sulphoiodide is a suitable material for application in the field of solar energy conversion and harvesting.

Acknowledgements. The authors express gratitude to Oleg Polozhentsev for spectroscopic measurements. The work was carried out within the framework of the SSC RAS state task (project number 122020100294-9).

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Vibration Characteristics of Faulty Spur Gears in One Stage Gearbox System

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A gearbox is one of the most essential components of spinning machinery. Its angular velocity can be changed to provide the desired torque and is used with other devices. The application is widely used in manufacturing, petrochemical, auto, power plant, and mechanical devices. Gearbox failure requires a diagnostic tool and an indicator. Data gathering and analysis are crucial. Data must be properly analyzed to avoid misunderstandings that could cause more problems. There are many types of condition monitoring equipment on the market, so it is important to choose the right one. A good study of the problem may resolve the underlying issue, preventing future occurrences. This research aims to distinguish between a healthy spur gear with a crack and a missing tooth spur gear with a crack, based on the vibration spectrum. Under different loads and speeds, the gearbox produces vibration signals in several of its components. Signal transmission channels and interference from other sources can distort these vibration values and reduce distortion for remote condition monitoring. In this research, the influence of transducer location and operating conditions on gearbox vibration signals were studied to identify gearboxes with induced defects. Gearbox malfunction caused these defects. The vibration signal coincides with gearbox spur second damage. First, the spur gear was cracked, then a tooth loss. Analyzing baseline vibration data is performed in a spectrum or frequency domain or FFT. Gearbox dynamic simulator (GDS) is used for the testing purpose (see Fig. 1). Advanced methods were used to compare results. Several criteria have been proposed for monitoring the data to ensure its accuracy and suitability as a reference source. Motor speed, load levels, and gear conditions are affected. This experiment needs a healthy, cracked, and missing tooth spur gear to achieve its two main objectives. Each spur gear condition must be simulated at three frequencies (10 Hz, 20 Hz, and 30 Hz) and three loads (0 A, 25 A, and 50 A). Crack spur gear and missing tooth spur gear had different peak frequencies, according to experiments. Missing tooth spur gear had 2 or 3 sensors, which exceeded 500 Hz,

that was equivalent to 30 – 40 % of the total number of sensors. At the same time, healthy spur and cracked spur gear were almost similar. Detecting small damage like a cracked spur gear was harder than spotting a missing tooth. They were only differentiated by 1 or 2 sensors that had a value exceeding 500 Hz, that was equivalent to 10 – 20 % of the total number of sensors.

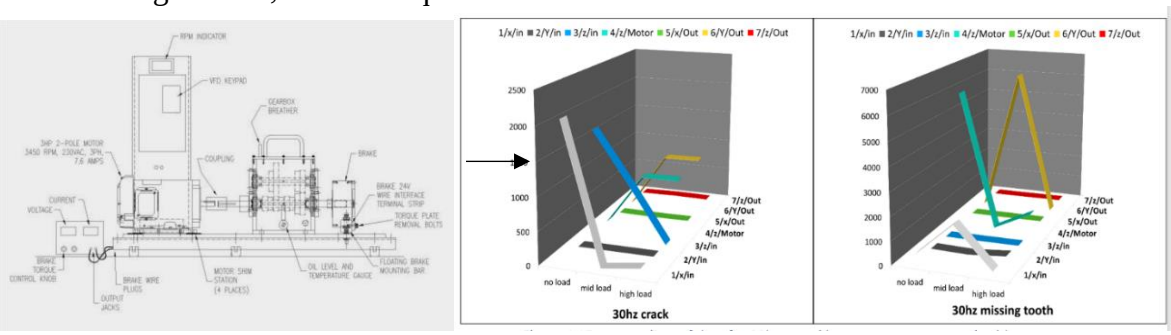

Fig. 1. Graphical representation of vibrational testing, using GDS

Case Study of Decision Making Based on Uncertainty Preparation of Payoff Matrix: A Case in PT Dua Putra Jaya

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PT. Dua Putra Jaya is a company founded in 2005 and led by Pak Roni, the owner of the company. The furniture company produces sofas, plastic chairs, and carved chairs. This furniture company has a vision, namely, to become a furniture company that can make customers satisfied with the goods it produces. In this study, an interview was conducted directly with Jono (the owner). This research was conducted by March 23, 2023 and used payoff matrix to determine maximum income. The next results were found: (i) PT. Dua Putra Jaya is a furniture company that has high productivity; (ii) PT. Dua Putra Jaya is a furniture company that manufacture sofas, plastic chairs, and carved chairs in a large scale; (iii) there is shift work, which is divided into two shifts, namely the morning and evening in order to achieve the maximum production target. There is a concrete suggestion, that is by applying the payoff matrix as a tool to determine the productivity index, the maximum income of the company could be determined.

Productivity Index Calculation Using Mundel Approach Data at PT. Dua Putra Jaya Furniture

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The development of the manufacturing industry furniture requires business actors to continue to increase the competitiveness of the products they produce. A company can compete with other companies comparing the measured level of productivity of the company. The measurement of productivity can show the results of measuring a performance by paying attention to the resources used so that efficiency and effectiveness can be achieved. Every company needs to account its

level of productivityso that it can still compete with other companies. One a such company is a manufacturing furniture company. In the previous few years, this company conducted only external and internal audits to see the level of company productivity. In this study, to measure the productivity level of the company, the Marvin E. Mundel method is used. The measuring period is from March 2023 to April 2023. Marvin E. Mundel method focuses on costs with the input data of material costs, labor, capital depreciation, direct labor, book value of capital, direct total costs, overall total costs, energy consumption, maintenance, absenteeism levels and income results as output data. There is a certain suggestion that is are obtained, namely, the labor productivity index has decreased by 23.7%, direct labor costs have increased by 14.2%, capital depreciation has increased by 17.5%, the bookvalue of capital has decreased by 30.1%, direct total costs have increased by 64.3%, overall total costs have increased by 0.6%, energy has increased by 8.9%, materials have decreased by 11.4%, maintenance has decreased by 10.22%, the absentee level was fixed.

Proposed Strategy for Increasing Productivity Based on the Results of Objective Matrix (OMAX) Method in the Transformer Production Department at PT. Gkuad Manufacturing (Case Study PT. GKUAD)

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Growth in the number of requests and the demands of maintaining good product quality remain a challenge for PT. GKUAD to compete in the world of manufacturing. It is necessary for the production and productivity measures proposed in the strategy of increased productivity future. Productivity measurement models in the PT. GKUAD use the Objective Matrix (OMAX) model with the criteria of measured productivity, which include the ratio of hours worked for utilities, electrical energy consumption, utility workers, defective product ratio, the ratio of good products, and the ratio of engine damage. Objective Measurement Matrix (OMAX) shows the ratio of first factor (utility work hours) is the dominant criterion value, but productivity is below standard. The ratio will be analyzed using the Logic Tree Diagram for the proposed strategy to get an increase in productivity.

Dependence of the Growth Mechanism of Thin Films Based on BSN on the Thickness of the Film

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Great interest is shown in heteroepitaxial structures, including multilayer ones. In the case of multilayer structures, it is critically important to know about the morphology of the surface of each of the layers of such a structure. In this report, the morphological properties of BST-50 ($Sr_{0.5}Ba_{0.5}Nb_2O_6$) thin films of different thicknesses, synthesized by high-current RF discharge on single-crystal MgO (001) substrates are investigated, the mechanism of film growth under the

conditions used is determined. After studying the change in the morphology of the sample surface for different thicknesses, it is possible to draw conclusions about the optimal synthesis conditions or about the quality of the film and its applicability for various purposes. One of the most informative methods of studying surface morphology is atomic force microscopy (AFM) [1]. Using AFM, information was obtained on the surface relief of four films, the thicknesses of which were 23, 45, 165 and 695 nm (see Fig. 1). Thanks to Gwyddion software [2], the lateral dimensions of objects on the surface of the films were determined and their dependence on the growth stage showed that first layer growth and then island growth were occurred. Based on the analysis of all images of the surface and the stages of film growth, it was found that under the used deposition conditions, the growth of films occurs by the mechanism of Stransky – Krastanov, namely 'layer-plus-island growth'. It is means that this mechanism is an intermediate case of film formation, that is, at the initial stage, a two-dimensional film layer is formed (by a layer-by-layer mechanism), after which, three-dimensional islands are arisen and begun to grow on the formed surface (by an island mechanism).

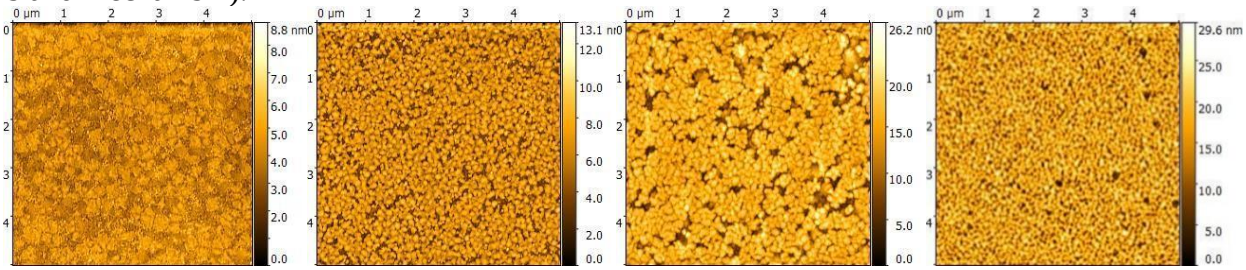

Fig. 1. Images of the surface of films after processing for 23, 45, 165 and 695 nm film thickness

Acknowledgement. The study was carried out with the financial support of the Ministry of Science and Higher Education of the Russian Federation (State task in the field of scientific activity, scientific project No. FENW-2023-0012).

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Dependence of the Roughness of BSN-based Thin Films on the Film Thickness Using Atomic Force Microscopy

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Solid solutions based on niobate-strontium barium $Ba_{1-x}Sr_xNb_2O_6$ (BSN) where $x = 0.5$, belong to the class of ferroelectrics and have a high value of pyrocoefficient and piezoefficiency, as well as a high value of dielectric permittivity. Thin films are a promising material, since there is a tendency to miniaturize various devices and, in addition, with a decrease in the size of films, new physical properties may appear [1]. In this work, the morphological properties of $Ba_{0.5}Sr_{0.5}Nb_2O_6$ (BSN) thin films of different thicknesses, synthesized by high-current RF discharge on single-crystal MgO (001) substrates are investigated. After studying the change in the morphology of the sample surface for different thicknesses, it is possible to draw conclusions about the optimal synthesis conditions or about the quality of the film and its applicability for various purposes. Atomic force microscopy (AFM) is one of the most informative methods for studying surface morphology.

Thanks to the AFM, information was obtained on the surface relief of four films, the thickness of which was 23, 45, 165 and 695 nm. For these BSN samples, the dependence of the surface roughness on the film thickness was revealed. Roughness is a set of surface irregularities, considered within the base length (the length of the area, allocated to characterize the surface irregularity). Thanks to the Gwyddion software [2], the parameters, pointed in Table 1, were obtained. The roughness of the studied samples increases with the increasing of thickness, but it should be clarified that the thickness of the film is inversely proportional to the intensity of the increase in roughness. It can be noticed that in the range from 23 to 45 nm, the roughness increases almost 5 times, and from 165 to 695 nm increases much less, even less than 50 percent, although the second thickness interval is much wider than the first interval.

Table 1. One-dimensional parameters of the sample surface

Film thickness / Parameter	23 nm	45 nm	165 nm	695 nm
Average roughness (R_a), nm	0.6	1.26	2.8	3.26
Root-mean-square roughness (R_q), nm	0.70	1.57	3.55	4.06
Asymmetry (R_{sk})	0.09	0.52	0.67	0.33
Maximum peak height (R_p), nm	4.7	7.07	11.8	13.6
Maximum depth of the depression (R_V), nm	4.1	6.03	14.4	16
Maximum height (R_z), nm	8.8	13.1	26.2	29.6
Median value, nm	4.1	6.25	15	16.3

Acknowledgements. The authors are grateful to Prof. Dr. I. A. Parinov (Southern Federal University, Russia) for his constant interest in the research field of modern piezoelectric materials and their applications. The study was carried out with the financial support of the Ministry of Science and Higher Education of the Russian Federation (State task in the field of scientific activity, scientific project No. FENW-2023-0012).

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3D Drawing in Autodesk Inventor Software

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Inventor is a 3D CAD application that provides professional-level mechanical design, documentation, and product simulation tools. Inventor software is used by mechanical engineers. Its main function is to model, simulate, and quickly communicate design ideas. It is especially suitable for engineers who need automated and specialized tools to design components and prepare them for manufacturing. One of the main used cases is GPU ray tracing, which supports hardware ray tracing used in the latest graphics cards. While the results of drawings that have been made in Autodesk Inventor themself have image standardization functions such as certainty according to and not according to the maker and reader of the drawing on an engineering drawing, drawings on a particular technical drawing, certain engineering drawings, ease of communication between makers and readers of drawings, and others. 3D sketch functions are used to create sketches that have length, width, and height dimensions or create images on the *X*, *Y*, and *Z* axes. With sketches, we can create images that are not only two axes; we can create images with the *Z*-axis as a measure of the height of the sketch we made. For example, making a bottle, making a pipe design, or anything else to resemble the original shape.

Analysis of Productivity Using the OMAX Method at Tessa Bakery

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Tessa Bakery is an industry that produces various types of cakes, both pastries and traditional cakes. This industry is also inseparable from problems, related to machine and equipment productivity. Based on the results of observations, made at Tessa Bakery, part of the production line, there is often a sudden stop in the production process. The termination will affect the expected product quality and production targets achieved. The problem, discussed in this study is how big is the productivity level of the production department, based on such criteria as (1) raw materials, (2) labor, (3) machinery and tools, (4) working hours, (5) energy consumption, (6) number of defectives, and (7) promotion. The productivity measurement method used is the Objective Matrix (OMAX) method, so the steps of this research refer to the OMAX steps, namely determining the production line productivity criteria or ratio, calculating the value of the productivity ratio, calculating the initial standard score (score 3), setting goals (score 10), and the lowest score (score 0), determining the weight, calculating the value or criteria value, determining the value of productivity for each period, and determining the percentage of the index. Using the OMAX method, it was obtained that in February 2021 (compared to January 2021), there was the highest increase in productivity for 15 considered months. This took place because the IP (Index of Performance) = 1.83 was positive and there was an increase in the calculated value at the time of measurement from 3.09 to 8.74. This increase was caused by an increase in the value of all criteria.

Drilling, Bending, Turning, and Assembly Processes in the Steel Shoe Rack Manufacturing Industry

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This report explains the identification and analysis of defects, resulting from the iron rack manufacturing process. We found some flaws that need to be repaired. The shortcomings include the tilt of the rebar during the freezing process, the defect in the cut due to welding, the incompatibility of the shelf cover components, and the uneven coloring. In order to overcome the tilt defect of the pendulum, it is necessary to make adjustments to the bending device of the plate and to carry out the refrigeration process on a pendulum. This will ensure that the rack is straight and strong so that it can support the load well. Cutting defects due to welding can be corrected by using a more precise cutting machine, cutting the parts of the connected components, affected by the welding process more carefully, and using more accurate tools. Thus, the cut will be more accurate and smooth. In order to overcome the inertia of the shelf cover components, it is necessary to discharge the uneven components and make adjustments to the position to align with the shelf frame. After that, the shelf cover component can be tightened carefully so that it is mounted well and tightly. The last disadvantage is the uneven coloring. To fix it, it is necessary to perform an

amplitude on the affected part of the defect and repeat the coloring process using a new pilox. Equal coloring on the entire surface of the rack is also very important for a uniform result. By repairing these defects, we aim to produce better steel shelves in terms of stability, precision, beauty, and strength.

Temporal Mapping of Coastal Areas Using Landsat Satellite Imagery

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Surabaya is one of the many coastal areas in Indonesia, which is an archipelago country. Land use changes have affected the coastal Surabaya. For several decades, there have been changes in land cover on the coastal Surabaya, especially in East Surabaya. Initially the coastal area was a mangrove conservation area, but the land function changed to become a pond area and residential area (urban area). The functions of these lands influence each other so that the coastline of Surabaya also changes. Remote sensing satellite imagery data can help to monitor coastal areas both land cover and coastline. In this research are used Landsat satellite image data 1994 – 2023. The method, used to classify land cover, is the guided classification method (Maximum Likelihood) while determines the speed of shoreline change using tools in ArcGIS, namely the Digital Shoreline Analysis System (DSAS). The purpose of this research is to determine changes in land cover and determine the rate of change of the coastline in Surabaya (erosion and accretion). Monitoring the Surabaya coastal area is needed to determine the correlation of changes in the coastal area to socio-economic aspects so that develops recommendations for better coastal area management for the Surabaya area.

A Convolution Integral Equation of the Third Kind in the Grand Lebesgue Spaces and Some Applications

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In this report, the following convolution integral equation of the third kind is considered:

$$c_\alpha\, t^\alpha\, x(t) = (h * x)(t) + g(t),$$

$$h(t) = \begin{cases} t^{\alpha-1}, & t > 0; \\ 0, & t \le 0, \end{cases} \quad 0 < \alpha < 1,$$

where $0 < c_\alpha < \infty$. We prove that, for specific values of the constant c_α, there is a solution $x(t)$, expressed through the inversion of the following integral operator:

$$K^{\alpha}\varphi(t) := c_{\alpha,p} \int_0^t \mathcal{K}_{\alpha}(t,\tau)\varphi(\tau)\,d\tau\,, \quad \mathcal{K}_{\alpha}(t,\tau) = \frac{t^{-\alpha}}{(t-\tau)^{1-\alpha}}, \quad t > 0,$$

on functions from the grand Lebesgue space $L_a^{p)}(\mathbb{R}_+)$. Such function spaces are defined by the following norm:

$$\|\varphi\|_{L_a^{p)}(\mathbb{R}_+)} := \sup_{0<\varepsilon<p-1} \left(\varepsilon \int_0^{\infty} |\varphi(\tau)|^{p-\varepsilon}\, a^{\varepsilon/p}(\tau)\,d\tau \right)^{1/(p-\varepsilon)},$$

where $1 < p < \infty$, and the weight function $a(x)$, $x > 0$, is called the grandizer.
In the given notions, the problem stated here is on the conditions for equation to have the solution for the specific grandizer, and, moreover, providing the way in which this solution can be constructed [1, 2]. We consider some possible applications of the developed method in control systems and discuss the problem of fractional order transfer functions.
Acknowledgement. The research was carried out at Southern Federal University with the financial support of the Ministry of Science and Higher Education of the Russian Federation (State task in the field of scientific activity, scientific project No. FENW-2023-0012).
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On the Conditioning of the Poisson Type Equation on a Sphere and Some Remarkable Outcomes

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The Riesz fractional calculus is a well-known theoretical approach for implementing the fractional order differentiation and integration of functions defined on multidimensional spaces, including the case of a unit sphere centered at the origin of the Euclidean space R^n [1]:

$$S^{n-1} := \left\{ x \in \mathrm{R}^n : |x| = 1 \right\}, \quad |x-\sigma| = \sqrt{|x|^2 + |\sigma|^2 - 2\,x\cdot\sigma}, \quad x, y \in \mathrm{R}^n.$$

Consider the Poisson type equation:

$$\delta^{\alpha/2} f = g, \quad f, g : S^{n-1} \to \mathrm{R}, \tag{2}$$

where $\delta^{\alpha/2}$, $0 < \alpha < 2$, is the fractional power of the Laplace—Beltrami operator:

$$\delta f(x') = |x|^2\, \Delta f\left(x/|x|\right), \quad \Delta f(x) := \frac{\partial^2 f}{\partial x_1^{\,2}} + \ldots + \frac{\partial^2 f}{\partial x_n^{\,2}}, \quad x' := \frac{x}{|x|}.$$

The operator $\delta^{\alpha/2}$ can be expressed as a composition with the spherical convolution operator P:

$$\delta^{\alpha/2} f(x') = P\left(I^{\alpha,\nu}\right)^{-1} f(x'), \quad P f(x') = \int\limits_{S^{n-1}} k_P(x\cdot\sigma) f(\sigma) d\sigma, \tag{3}$$

the kernel k_P of which is known. The operator $\left(I^{\alpha,\nu}\right)^{-1}$ is inverse to the spherical Riesz potential:

$$I^{\alpha,\nu} f(x') := \frac{1}{\gamma_n(\alpha)} \int\limits_{S^n} \frac{f(\sigma)}{|x'-\sigma|^{n-\alpha}} \ln^{\nu} \frac{\sqrt{2}}{|x'-\sigma|} d\sigma, \quad \nu = \begin{cases} 0, & \alpha \neq n+2k, \\ 1, & \alpha = n+2k, \end{cases} \quad k \in \mathrm{N}_0, \tag{4}$$

where $\gamma_n(\alpha)$ is the normalizing constant, given in the report. The presented study is aimed at the generalization of (3) for the case of

$$0 < \alpha < 1, \quad \nu > 0. \tag{5}$$

We establish relations, close to (2), and compose the structure of $\left(I^{\alpha,\nu}\right)^{-1}$ in the assumptions (4) based on the results of [3, 4]. As a result, we propose an equation that is analogous to (1) and investigate its conditioning using the approach of the generalized Hölder spaces [2].

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On Particles Distribution in Mean Field Models Evaluated through Hypersingular Integrals

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The mean field kinetic models are purposed on describing the dynamics of a very large number of identical particles, assuming that the interaction between them is known exactly [1]. Consider the Euclidean space R^n; an effect on such a particle, located at the position x, by a cloud of particles with number density $\rho(t,y)$, where t is the temporal variable, is described by the function:

$$F(t,x) = c \int\limits_{\mathrm{R}^n} \frac{x-y}{|x-y|^n} \rho(t,y) dy, \quad x, y \in \mathrm{R}^n, \quad n \in \{2,3\}.$$

The nature of constant c depends on a mathematical model studied. For instance, in plasma physics, F means the electrostatic force, and, by c, the charge of particles and the dielectric

permittivity of vacuum are considered. It is important, however, that the function F can be treated as an image of ρ due to mapping by the Riesz potential type operator of a fractional order, which is implied by the following representation:

$$F(t,x)=c\int_{\mathrm{R}^n}\theta\left(\frac{x-y}{|x-y|}\right)\frac{\rho(t,y)}{|x-y|^{n-\alpha}}\,dy=:K_\theta^\alpha\rho(t,x),\quad \theta\left(\frac{x-y}{|x-y|}\right):=\frac{x-y}{|x-y|}\cdot\frac{1}{|x-y|^{\alpha-1}},\quad 0<\alpha<1.$$

The function $\theta(\xi)$ is called a characteristic of the potential-type operator, and it is clear from the given equation, that it has a discontinuity of the homogeneous function type. In this report, we discuss the possibilities of expressing the function ρ through F by using the theory of hypersingular integrals [2], and some applications in mean field kinetic models.

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The Solvability of Integral Equations of the First Kind with Mild Singularity Kernels

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Multidimensional integral equations of the first kind are widespread in various areas of mathematical physics, mechanics, and engineering. The subject of this research is integral equations with spherical convolution operators and the conditions for them uniquely solvable in the generalized Hölder spaces. These function spaces are considered as characterizing the stability of solutions, which is a topic relevant for numerous applications in applied sciences.

To be specific, we study the integral operators of the type [1]:

$$K\,f(x)=\int_{\mathrm{S}^{n-1}}k(x\cdot\sigma)\,f(\sigma)\,d\sigma,\quad x\in\mathrm{S}^{n-1},$$

where S^{n-1} symbolizes a unit (hyper)sphere embedded into the Euclidean space R^n, $n=2,3,4\ldots$. The distinctive feature of K is that its kernel k is a function of the inner product, which allows one to use the theory of the Fourier – Laplace multipliers for spectral analysis. We are particularly interested in classifying operators, generated by spectrums with the property:

$$k_m\sim c\cdot m^{-\alpha},\quad c>0,$$

and such that the equation $K\,f=g$ is uniquely solvable in the generalized Hölder spaces:

$$H^{\omega(\cdot)}(\mathrm{S}^{n-1}):=\left\{f:M(f,t):=\sup_{\substack{|x-y|\le t\\ x,y\in\mathrm{S}^{n-1}}}|f(x)-f(y)|\le C\,\omega(h)\right\},\quad 0<C<\infty.$$

We use theorems on isomorphism of the generalized Hölder spaces in terms of multipliers classification and introduce the classes of operators that provide a unique continuous solution to the equations of mathematical physics and applications [2].

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The Effect of Approach in the Contact Problem for Two Elastic Parallel Circular Cylinders

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In contact mechanics, there are two opposite viewpoints on the way in which the radii of two circular cylinders influence on the deformation of these bodies. While some of the approaches [1–3] consider its universality as a theoretically proven factor, the others (e.g. [4]) state this influence is absent. These both groups of methods are applied in mechanical engineering without discussing the reasons for contradictions to take place. The selective effect of the contact approach [5], called here "EA" for short, is verified theoretically basing on the results of [3] and evaluated through a detailed comparative analysis on two fundamentally different in their theoretical foundations, types of techniques, namely [1] and [4]. The analysis indicates the limits in which the approaches are reliable, and outlines that the methods of type [4] cannot be recommended for applying in mechanical engineering, while [1] and the methods of its type stay accurate in a wide range of parameters' values. EA turns out to have the following significant implications:

(i) EA's being revealed [5] allows one to estimate the accuracy of any method and avoid rough errors in calculating the strains of elastic bodies, modelled with parallel circular cylinders [6].

(ii) The methods of type [1] are expected to become widely adopted after their being improved, as they consider EA implicitly.

(iii) Applying EA and corresponding solutions in mechanical engineering is to improve contact a unit's lifetime significantly and increase the operating performance and sustainability of machines.

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Study of In Wetting Layer Formation on GaAs Using Density Functional Theory

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Droplet epitaxy is flexible method for growth of quantum dots (QDS), allowing to control shape and density of resulting structures. It relies on formation of metal droplets from single wetting layer (Volmer – Weber growth mode) that then are crystallized by annealing in group-V element atmosphere. Initial droplet formation is crucial in this process as it defines size and distribution of resulting QDs. In this work, we study the adsorption energy of In wetting layer, forming on the As-stabilized GaAs surface, depending on substrate coverage in order to understand the kinetics of formation of the first wetting layer that is required for subsequent adatoms to follow Volmer – Weber growth mode, forming 3D nanostructures.

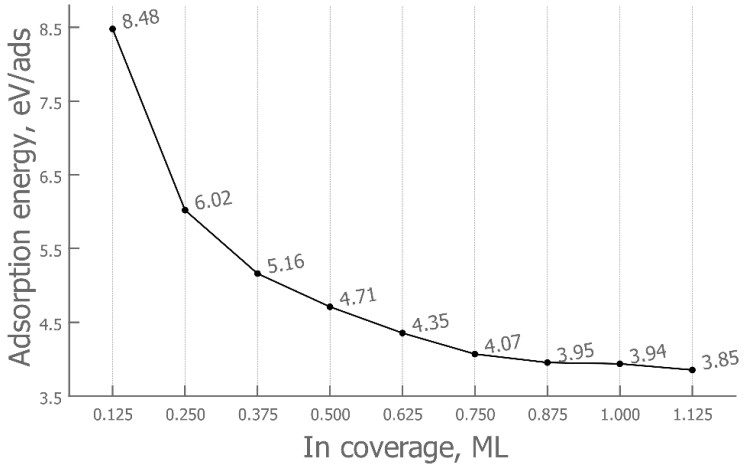

Fig. 1. Adsorption energy, depending on coverage.

Calculations based on density functional theory [1] showed (Fig. 1) that $E_{ads/adatom}$ highly varies depending on coverage. Highest E_{ads} of 8.48 eV was shown for coverage of 0.125 ML, which results from adding 1 adatom in 2×2 simulation cell. Being very high for a single adatom this value can be explained by induced reconstruction of pristine GaAs surface. At higher coverages there is

significant decrease in E_{ads}, which nonlinearly goes down to 3.85 eV, meaning that something in growth process of wetting layer significantly weakens its interaction with substrate. Moreover, surface reconstruction this behavior can be explained by adsorbate induced shift in *d*-band center of electronic structure [2]. This can lead to higher rates of surface diffusion of following adatoms forming QDs increasing their size and decreasing density.

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SIMS Study of $LiNbO_3$ Thin Films Fabricated by Pulsed Laser Deposition

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Today humanity faces challenges are directly related to the scarcity of resources and pollution. As one of the possible approaches to solve these issues is considered the creation of autonomous environmentally clean power generators, to supply with energy low-power devices that require a high degree of autonomy and controlled physical and chemical parameters [1]. Secondary ion mass spectrometry (SIMS) with depth profiling was used to quantitatively study the composition and mutual diffusion phenomena in $LiNbO_3$ films, obtained on the Si/SiO_2 structure by pulsed laser deposition (Fig. 1).

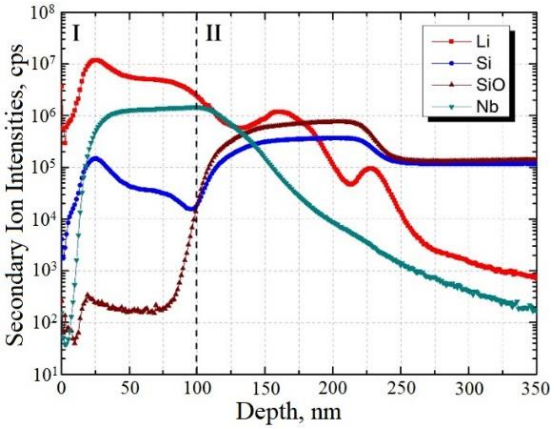

Fig. 1. $LiNbO_3$ films, obtained at oxygen pressure of 1×10^{-2} Torr (I – film II – substrate regions)

It was found that the films, obtained at oxygen pressure of 1×10^{-2} Torr, are close in composition to stoichiometric $LiNbO_3$. The change in stoichiometric composition during film deposition in vacuum (residual pressure 1×10^{-5} Torr) may be caused by loss of volatile lithium at high temperature or arise from a chemical reaction at the interface between the oxidized silicon surface and previously deposited lithium niobate with formation of amorphous silicate according to the chemical formula: $3LiNbO_3 + SiO_2 \rightarrow LiNb_3O_8 + Li_2SiO_3$. Since the saturated vapor pressure of

Li_2O is relatively low at high temperature [2], the observed Li deficiency during film deposition in vacuum is probably due to evaporation or interfacial reactions. Thus, the formation of high-quality $LiNbO_3$ films with a composition close to stoichiometric is possible only with their *in-situ* crystallization.

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Surabaya Sport Museum

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The Surabaya Sports Museum is a museum built to illustrate the spirit of the Indonesian people in Surabaya to exercise. This museum is located at Jalan Indragiri No. 6, Gelora Pancasila, Surabaya City. This museum contains historical stories as well as objects that are evidence of the legacy of the Surabaya Sports Warriors and Heroes. Established as an honor for Surabaya athletes who excel in raising the red and white flag in international events. With a total building area of 501m², this museum is located in the Pancasila Sports Hall complex and the THOR field, emphasizing the spirit of war to make the country proud. It has a collection of original medals donated by athletes from Surabaya to augmented reality technology which allows visitors to take pictures with legendary athletes from Surabaya. It consists of two floors; on the first floor, you can find collections of folk/traditional sports, and words of inspiration from athletes, while on the second floor, there are collections of various types of sports including: pencak silat, wrestling, badminton, tennis, beach volleyball and others. There are 235 kinds of collections divided into three types. The first type is a historical collection, obtained through findings, excavation results or historical material evidence with a total of around 169 pieces. The second type is a heraldic collection, namely in the form of awards or service marks, ranks, and symbols or logos with a total of around 65 pieces. The third type is a technological collection in the form of objects with technological elements, this collection consists of one.

Analysis of the Reasons for the Development of Defects of Outside Concrete Wall Panels

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Prefabricated reinforced concrete wall panels for exterior walls are characterized by a number of advantages relative to the wall structures of monolithic construction, erected in the conditions of

the construction site: convenience and speed of installation, guarantee of compliance with the standardized indicators of the manufacturer, reducing the cost of external and internal finishing due to almost complete factory readiness, significant operating life, not requiring constant monitoring by the operating services [1]. However, the defects of prefabricated elements, in particular exterior walls, such as cracks, extrusions and deformations of panels, freezing of walls and mounting joints, surface destruction with subsequent corrosion of reinforcing elements state a serious threat to the life and well-being of tenants, and repair of such structures is difficult, expensive and often requires the resettlement of tenants for the time of restoration of operational reliability [2], which led to the choice of research work direction, namely analysis of the causes and development of defects of exterior walls. General defects in structures can include: (i) deviations from the design position of the structures; (ii) non-conformity of the quality of used building materials with the design documentation and the requirements of the state standards; (iii) non-compliance of geometric dimensions of separate structures with the requirements of design documentation creating difficulties in the process of installation of structures; (iv) mechanical damage during transportation, loading and unloading (chips, potholes, dents and other damages that are most often caused by strikes of machinery in passageways and passages. The analysis allowed us to establish the main causes of occurrence and development of defects of exterior wall panels: (i) defects of factory production up to 10 %; (ii) poor quality of installation in up to 45 % of cases; (iii) unsatisfactory operation up to 20 % of the cases. The largest percentage of defects in the construction of exterior walls is due to violations of the technology of joining wall panels and making installation joints, namely poor quality of mortar, insufficient quantity of mortar, violation of the technology of joining structures. These causes can be eliminated with timely technical supervision and compliance with production discipline. Competently organized operational and acceptance control of each stage of construction and erection works provides a design level of quality of separate structures and the building as a whole.

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Extending the Useful Period of Three-layer Panels

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Builders and operating organizations are obliged to provide the required level of energy efficiency of buildings. Today citizens actively invest in new construction and, buying apartments, are waiting for a high level of safety and comfort of living [1]. The required level of thermal resistance of wall structures has increased by 3.5 times, compared to previous standards, so there was a problem of its practical provision, the solution was the development of three-layer wall structures. To ensure the safety, durability and aesthetics of external wall structures it is necessary to ensure the compliance of quality indicators with the requirements of standards at all stages of the life cycle, paying special attention to the operating phase, which in further operation is not subject to control for compliance with energy efficiency requirements. Article [2] describes the problems

that have appeared after 7 – 10 years of exploitation of three-layer wall panels, namely destruction of the outer layer of concrete with exposure of reinforcement on the panel and on the ribs and corners, surface wetting, rotting of the inner layer of the insulation. These defects can be effectively prevented if construction and technical expertise are conducted regularly, which will establish the actual values of the density and strength of the layers of the structure, the tightness of the inner layer, the level of stress during installation and operation, the impact of external weather factors and the maintenance of corrosion protection. This study is devoted to the problem of prolongation of service life of outer building envelopes by means of timely technical diagnostics of their condition and repair works. There are considered modern fracture methods of building and technical expertise, as the most informative, and methods of nondestructive testing. Attention is paid to the choice of testing equipment and measuring instruments. The equipment is chosen in accordance with the test procedure, which regulates the accuracy and measurement uncertainty of the tests. The methodology establishes the compliance of the used measuring instruments and their metrological characteristics to the requirements for ensuring the accuracy of measurements. The information about the actual condition of the building envelope will allow one to reveal dangerous defects in time and prolong the service life of the building for many years, ensure comfort, safety and savings in payment for housing and communal services for the tenants.

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The Program of Technical Expertise of the Object in Pre-emergency State

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The research work is devoted to development of the Program of technical inspection of a multistoried apartment house in a pre-emergency condition. For deciding on demolition or reconstruction of a building, it is necessary to carry out technical inspection of all supporting designs and some elements of a system of a facade and a roof [1]. A detailed (instrumental) inspection of buildings in a pre-emergency condition should be continuous (complete) because it is a question of assessing the operational reliability of the building [2]. A program for evaluating the technical condition of the building's structures has been developed that includes the following scope of work: (i) description of the general structural scheme of the building, step of the supporting structures, types of structures used, type, geometric dimensions, method of installation of the exterior cladding; (ii) evaluation of the difference in the levels of the foundation structures with respect to the uniformity (nonuniformity) of the settlement; (iii) evaluation of flatness of building facade structures, relative displacement of vertical and horizontal edges in cross joints of external facing panels, possible displacement of panels on the external surface, measurement of deviation of upper structural elements of facing from the vertical; (iv) GPR survey of control areas around the perimeter of the building to detect (absence of) signs of ground subsidence, individual local decompressed areas, buried piles and individual foundation structures; (v) evaluation of the thermal-technical characteristics of the facade system; (vi) determination of tightness of joints of the facade system elements; (vii) examination of the degree of damage to load-bearing and

enclosing structures and joints. All characteristic damage and destruction shall be fixed, photographed and entered in the "Defects List". The results of the technical inspection allow establishing the category of the technical condition of the structures, the necessary amount and cost of work to restore the destroyed structural elements or parts of the object and, if necessary, make changes to the previously prepared design documentation or prepare a new one.

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Preparation of Organomineral Admixture for High-Functional Concretes

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Saving of cement solves economic and environmental problems. It is calculated that cement production consumes about 5 % of world industrial energy [1]. Each ton of cement produces up to 1 ton of carbon dioxide, emitted into the environment, which increases the risk of global climate change. A significant saving of cement is possible by replacing part of it with a complex organic-mineral additive (OMA) obtained from various industrial wastes such as expanded clay dust, opoka, microsilica, metallurgical slag, fuel wastes from thermal power stations and others [2]. The choice of mineral component of OMA requires special research and depends on specific local conditions, as well as the technical and economic efficiency of the results obtained [3]. The aim of the research is to choose the composition of complex organic-mineral admixture, to establish experimentally the optimal degree of waste crushing and to estimate the proportion of mineral and organic components of the complex admixture, which makes it possible to reduce cement consumption without losing the strength of concrete. The basic was taken the composition of concrete grade B25/P4 for the monolithic house building. Portland cement CEM I 42.5H of Sebryakov cement plant (Russia) was used. As a coarse aggregate, a crushed stone from Potapovsky quarry in Rostov region was used in fractions of 5 – 20 mm, a grade of crushability was 1200. The fine aggregate was sand Leventsovsky quarry of the Rostov region with a particle size modulus of Mk = 1.56. An organic component was adopted by superplasticizer company "Sky Trade" St 2.1, delivered in the form of an aqueous solution of 25 % concentration. As a mineral component of the complex admixture, the fine crushed ash and slag waste of Novocherkassk Thermal Power Station were used. Mathematical methods of experiment planning theory were applied to optimize the composition of OMA. A quadratic polynomial model was developed, and its geometric image was built. In the result of this study, it has been established that, depending on the degree of ash-and-slag waste grinding within the range from 2400 to 4000 cm^2/g, cement consumption is reduced by up to 20 % without loss of concrete strength. It is expected to use the method of mathematical modeling in further research aimed at expanding the nomenclature of organomineral additives, based on waste processing of sedimentary (limestone-shell rock, opoka, etc.) and volcanic rocks (tufa, perlite, pumice, etc.), which are local raw materials in one or another region.

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Technical Inspection of the Building during the Renewal of Unfinished Construction

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In the event of the renewal of construction, the builder is obliged to conduct a technical inspection of the object as part of the construction and technical expertise [1]. A detailed (instrumental) examination of the ground and foundations, as well as all supporting structures, regardless of the nature and extent of defects and damages, even if visually well, must be total (completed) [2]. Developed strategy to estimate the technical condition of the building structures after a prolonged period of stoppage of construction, providing for the following work:
(i) estimation of the degree of completion of the building, namely what work has been performed, how many floors have been built, how the quality of the completed construction and construction work corresponds to the design documentation and the further use of the object;
(ii) description of the general structural layout of the facility with a list of already erected and planned structures, types of structures used, type, dimensions, method of installation of the exterior cladding panels;
(iii) assessment of the difference in the level of the foundation structures with respect to the regularity (nonuniformity) of the settlement;
(iv) assessment of the flatness of the building facade structures, the relative displacement of vertical and horizontal edges in the cross joints of the external facing panels, the possible displacement of the panels on the outer surface, measuring the deviation of the upper structural elements of the finishing elements from the vertical;
(v) GPR survey of control areas around the perimeter of the building to detect (absence of) signs of ground subsidence, individual local decompressed areas;
(vi) assessment of the thermal-technical characteristics of the facade system;
(vii) determination of the effectiveness of the facade system joints;
(viii) examination of the condition and degree of damage for already constructed structures and implemented interface joints; in this case, all typical damage and destruction must be recorded, photographed and entered in the "Defects List".
The results of the technical expertise will make it possible to determine the technical category of the building and the necessary scope and cost of work to restore the structural elements of the structure that were lost or destroyed during the conservation period (suspended "frozen" construction) and, if necessary, make changes to the previously prepared design documentation or prepare a new one.

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Methodology for Assessment of Atmospheric Resistance of Hinged Facades

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The facades of buildings are subject to various types of influences: force and atmospheric loads, changes in wind loads on the height of the building [1]. With proper installation of the hinged facade, the unrepaired period of exploitation can be at least 50 years. However, as practice shows, after 7 – 10 years from the beginning of the exploitation of the building the defects appear, namely the fracture of the facade elements, wetting and corroding of the inner layers of the insulation material, corrosion of the facade plates surface [2]. The main reason for the appearance of defects and reduced performance is a violation of the installation technology of the facade boards and defects in the execution of the joints. These problems can be prevented by careful quality control of installation work and timely technical inspection and repair of damaged elements [3]. To assess the quality of installation of panels and to establish the water resistance of the joints, a method of evaluating the weather resistance of the facade has been developed. The laboratory has tested the joints of the facade panels on the developed sprinkler system, which simulates slanting rainfall with precipitation up to 100 mm/h and a drop size up to 2,000 microns. The locations of water leaks, the pressure drop at which the leak occurred, the time elapsed since the start of the test, and the location at which water penetration occurred were recorded. We plotted the water permeability test joints for a final reference pressure of 300 and 700 Pa. A regression model was built. The analysis of the regression equation showed that the water resistance of the joints depends on the following factors:

(i) the width of the gap between the facing panels (when the width of the gap changes from 3 to 9 mm, the proportion of moisture penetration increases to 51 %);

(ii) the size of the facet on the end faces of facing boards (water penetration with increasing chamfer size from 0 to 5 mm decreases from 56 % to 43 %);

(iii) direction of wind and rain flow (the maximum water permeability was recorded in the perpendicular direction and the water permeability of the joints decreases sharply when the angle of incidence of rain flow decreases below 45° and increases above 135°).

It was found that the size of the joint between the faces of the panels should be no more than 6 mm, and the angle of the upper and lower faces to the horizon should be in the range from 20 to 30°. The size of the panel has almost no effect on the water permeability of the joint. The conducted research will allow to optimize the installation parameters of the cladding panels during their installation, which will increase the reliability and durability of the facade of the building.

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Complex Construction-technical Expertise of Masonry

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The research work was performed within the judicial expert assessment of the dispute about the quality of masonry work, performed from a party of bricks with visual signs of non-conformity to the requirements of the normative standard. To the quality forming indicators of such goods as ceramic facing brick include, in addition to quality characteristics, indicators of appearance, such as indicators of perfection of production implementation. They cover clarity of the edges, corners, color and even tone of the front surface in the party of products, the absence of unacceptable defects, namely signs of overburning, unfired, cracks, chips, extraneous inclusions [1]. In the research work, it is considered a disputed case of claim for different tone in the volume of the facial surface of the brickwork facade of the building from decorative facing bricks of non-standard color "pistachio". The developer is claiming bricks from a different party, possibly discounted for non-conformity. A methodology is presented for conducting an expert examination of bricks in finished masonry, which includes: (i) determination of the strength parameters of masonry by nondestructive testing methods (ultrasonic, vibrodynamic, mechanical methods); (ii) geodesic grading to establish the parameters of the spatial positioning of the brick wall; (iii) assessment of conformity of appearance parameters to the standard and the agreement conditions of the contract of delivery [2]. Discoloration is not a defect that reduces the performance, but its availability may be a consequence of underburning. Modern palette of facing bricks is quite diverse and if the unburned color is easy to identify in the party "brick" color, the range of fancy colors ("pistachio", "straw", "flamingo", etc.) may not be identified, which can lead to reduced performance characteristics up to emergency destruction. Complex construction and technical expertise, conducted by an experienced expert, is the guarantor of an objective assessment of quality and safety of construction materials and processes, will identify and prevent the replacement of quality materials for non-compliant with the project and the requirements of the standards.

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Mathematical Modeling of Structure and Properties of Concretes Obtained by Resource-saving Technology

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Nowadays, resource-saving technologies are actively developing all over the world. Significant experience has been accumulated in the reuse of various construction wastes such as crushed concrete, bricks, mortar, etc. It is known that secondary materials differ significantly from their natural counterparts and change the properties of concretes based on them [1]. A distinctive feature is the instability of structure and composition of recycling products. It is not always possible and economically feasible to carry out normalization of the composition of secondary raw materials. Researchers propose to compensate for the negative impact of different-modular components with expanding and shrinkage-free cements. To compensate for shrinkage in concrete, it is reasonable to modify Portland cement with expanding additives instead of using expensive expanding cements of industrial production [2]. The purpose of this research work is to select the composition of structural concrete with improved performance characteristics and study its properties using the methods of mathematical and *in-situ* modeling. We have studied the possibility of developing compositions and studying the properties of concretes modified by expanding sulfoaluminate-type additive with different-modular aggregates. A factorial experiment according to Hartley-5 (Na-5) plan has been implemented in the work. The number of points of the plan was taken equal to 27. The analysis of the Na-5 plan was carried out using an engineering mathematical program Matcad. The reproducibility variance was determined by the results of parallel experiments in each point of the plan. As a result of mathematical processing of the experimental data, adequate models of the studied response functions were obtained. By methods of linear algebra on the regression equations, the geometrical images of the studied response functions were constructed. The analysis of geometrical images of the investigated response functions made it possible to determine the optimal limits of variation of the main input parameters in order to obtain concretes with compensated shrinkage with different-module inclusions. The analysis of subdomains of the factor space allowed one to recommend the concentration of the expanding sulphoalluminate type additive within the range of 8 – 12 %, and the concentration of low-modulus inclusions of no more than 34 – 35 %. The performed studies have revealed high efficiency of methods of mathematical and *in-situ* modeling for the purposes of directed structure formation and formation of preferable properties of structural concrete, which is a certain contribution into development of innovative directions of resource-saving, enrichment of raw material base, improvement of ecological situation due to efficient use of production wastes.

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Effect of the Percentage of Sugar Factory Kettle Ash and Coconut Shell Charcoal on the Calorific Value of Briquettes

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Fossil energy scarcity refers to a condition, where the supply of fossil energy resources, such as coal, oil, and natural gas, is running low. Fossil energy resources are naturally formed millions of years through geological processes and take a long time to be renewed. Hence, renewable energy is needed to substitute fossil energy. Charcoal briquettes made from a mixture of sugar factory kettle ash and coconut shell charcoal potentially become an environmentally friendly and sustainable solid fuel. Manufacture of charcoal briquettes using this mixture can have several benefits, including the reusable of industrial waste, good combustion properties, and potential as renewable energy. In this study, the percentage of sugar factory kettle ash was more than that of coconut shell charcoal, specifically 50 %, 60 %, and 70 %. The briquette's forming process uses a press machine. The bomb calorimeter was used to determine the calorific value. The higher percentage of sugar factory boiler ash, the lower the calorific value. The highest calorific value is in a mixture of 50 % sugar factory kettle ash and 50 % coconut shell charcoal, which is 1509.1 cal/g.

Productivity Measurement with OMAX Method (PT. Sentosa Abadi)

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PT. Sentosa Abadi is a company, engaged in printing, where the company wants to increase good productivity. The absence of systematic measurements to increase productivity on the production floor makes the company's 2022 production target not achieved for the packaging printing category (Agustina, 2011). Productivity measurement is carried out using the objective matrix (OMAX) method. OMAX is a partial productivity measurement system, developed to monitor productivity in each part of the company with productivity criteria, that are in accordance with the existence of objectives. This model was developed by Dr. James L. Riggs (Department of Industrial Engineering at Oregon State University) (Avianda et al., 2014). OMAX was introduced in the 1980s in the United States. Judging from the criteria in the table, OMAX productivity is measured from the level of efficiency and effectiveness of using labor, machinery, and energy consumption. Then, targets and weights are determined for each criterion in the case of PT. Sentosa Abadi has 5 criteria with 18 periods processed by data. So, in the result, the Productivity Index (IP) at PT. Sentosa Abadi showed the rise and fall of productivity during 18 periods, starting from January 2022.

The Effect of Investment Decisions, Funding Decisions, Profitability and Interest Rates (Bi Rate) on Firm Value in Food and Drink Companies

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This study aims to examine and analyze: (i) whether investment decisions have an influence on firm value, (ii) whether funding decisions have an influence on firm value, (iii) whether profitability has an influence on firm value, (iv) whether interest rates (BI Rate) have an influence on firm value. The data used in this study are secondary data. The sampling method is non-probability, and the sampling technique uses purposive sampling. Based on the existing criteria, 10 samples of food and beverage companies are obtained. The data analysis technique used multiple linear regression analysis using the SPSS program version. The results of this study indicate that: (i) investment decisions have a positive and significant effect on firm value, (ii) funding decisions have a negative and significant effect on firm value, (iii) profitability has no effect on firm value, (iv) interest rates do not affect the value of the company.

Productivity Measurement Using the Objective Matrix Method at PT Yupi Indo Jelly Gum

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PT. Yupi Indo Jelly Gum is a candy manufacturing company in Indonesia. PT. Yupi has a wide market throughout the world. After joining Trolli, one of the largest chewing gum manufacturers in Europe, Yupi has been the leader in the confectionary market in Indonesia and Southeast Asia since 1996. Yupi Indo Jelly Gum has a goal to continue to grow into a company that has high quality by bringing together various kinds of resources, including natural resources by combining their human resources, as well as the maximum utilization of technology. The Objective Matrix (OMAX) is a performance measurement method that evaluates several productivity criteria with weights to get the overall productivity index. This model proposes the development of productivity at the level of activity. OMAX combines productivity criteria into an integrated form and relates them to one another. The advantages of the OMAX method in measuring company productivity are that it is relatively simple and easy to understand, easy to implement and does not require special skills, and the data is easy to obtain. This method is also useful for projects and service functions, where productivity is difficult to measure. In this study, there are seven inputs: raw materials, labor, machinery, energy consumption, machine maintenance costs, equipment rental fees, and packaging costs. Based on the above graph, there is a decrease in performance, but then it increases again, that is February – April, June – August, September – December, and January – February. For further information, the productivity index was calculated in these months. Thus, the Productivity Index for April was 1.87, for August was 4.00, for December was 0.77), and for February was 0.93.

Development of Java Coastal MSMEs Based on Blue Economy

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Indonesia is the biggest archipelago in the world, with 17,508 islands. The goal of the blue economy development framework is to enhance Indonesia's position as an archipelagic nation with a variety of marine resources as well as its strategic political and economic position. Because of its vast and diversified coastal habitats, including mangrove forests, coral reefs, and seagrass beds, Indonesia is regarded as the nation with the largest wealth of marine biodiversity in the entire globe. The idea of Indonesia's blue economy is built on the marine potential of the country's archipelagic archipelago; hence, it is important to protect marine resources since they will have an effect on long-term food supplies. This is consistent with the goals of the national maritime development policy, which is to materialize Indonesia as an archipelagic nation that is independent, developed, strong, and based on national interests through ecologically friendly and sustainable marine economic growth. Given that the blue economy involves a variety of sectors and actors, an integrated and comprehensive approach was used in the creation of the framework for the growth of the blue economy. To achieve a balance between conservation and usage of marine and coastal resources and to generate more sustainable and equitable welfare, the development of a blue economy thus demands collaboration between actors and sectors. People who reside in coastal areas and engage in socioeconomic activities using marine and coastal resources are referred to as coastal communities. Because of their reliance on coastal resources, they develop a culture. The development of micro, small and medium enterprises (MSMEs) along the coast of Java Island based on the blue economy can be accomplished in a lot of ways, such as (i) MSMEs of grilled fish on the coast of Pandeglang Beach; (ii) development of fishermen and MSMEs in Situbondo Regency; (iii) generating the economy on the Pangandaran Coast; and (iv) seaweed cultivation in the coastal district of Sidoarjo.

Ecoprint: Contemporary Batik Materials Using Plant Waste

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The art of batik is created directly by human hands using wax and a canting as a medium for drawing. The United Nations Educational, Scientific, and Cultural Organization (UNESCO) has recognized Indonesian batik as a masterpiece of the oral and intangible heritage of humanity. The methods, symbolism, and culture used to create hand-dyed batik of cotton and silk have been assimilated into Indonesian society. Batik itself is a custom that is passed down from generation to generation. Indonesians work with batik in a variety of settings, from youth to adulthood. Babies have also been carried in batik cloth since infancy, and when they pass away, batik material is frequently used to cover them. An eco-friendly form of batik is called ecoprint batik. Natural substances are required, with no synthetic or artificial components. As a result, neither the water waste nor the soil, air, or water it touches are contaminated. The resulting motif differs from written batik and other batik. The design of ecoprint batik is more current or contemporary. Plants (leaves, twigs, bark, or flower petals) are the primary source of the materials for ecoprint batik, together with plain cotton and an alum solution. For batik designs or motifs, leaves, twigs, bark, or flower

petals are used. Commonly speaking, the leaves, which also serve as colors, are what are frequently employed. Not all leaves can be utilized. The three requirements for leaves that can be utilized for ecoprint batik are: (i) sharp colors; (ii) a specific thickness (not too thin or too thick) and (iii) the leaves of these plants have non-slippery leaf surfaces. To ensure necessary colors, created by the tannins in the leaves and their perfect permeating and persisting for a long time, the fabric must be manufactured from natural fibers. There are three different eco-printing methods, including pounding, steaming, and leaf fermentation. Using a hammer, the pounding technique involves striking the fabric with leaves or flowers. This hammering method resembles printing leaf designs on fabric. To remove the color pigments from the leaves, which have been arranged on a fabric covered with plastic, the hammer is slammed against the leaves. The steaming method involves placing branches of plants, flowers, or leaves on a piece of cloth, rolling it around a log, and then steaming it. The fermentation process involves soaking leaves, flowers, or other plant parts that contain natural colors in vinegar. The plant material is placed on an evenly oiled cloth after soaking.

Renewable Energy: Charcoal Briquettes from Coconut Shells

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An alternative to dealing with climate change and technological advancements is the use of new and renewable energy. Fossil fuels, which have long been a source of power for many parts of life, are now running out because of constant use. The utilization of new and renewable energy has its roots in the excessive carbon dioxide emissions caused by fossil fuels. Sustainable organic resources can be used to create new, sustainable energy sources, including biomass fuels made from organic waste. Organic material, created by a photosynthetic process, is known as biomass, and it can take the form of waste or finished goods. Organic energy sources found in biomass can be transformed into a lot of different forms. Bio-briquettes are ones of them. One of the renewable resources that can be utilized as an alternative fuel, including for briquettes, is biomass. Coconut shell is one types of biomasses that can be utilized as the primary ingredient in the production of briquettes. A potential waste that can be directly turned into briquettes is coconut shell. Briquettes made from coconut shell charcoal are produced through pyrolysis, crushing or grinding, mixing, compaction, and drying. Briquettes, created from coconut shell charcoal, have a lot of benefits, including not producing smoke, producing a high degree of heat, being environmentally beneficial, and having a longer burning time.

Sustainable Blue Economy Development as an Effort to Improve East Java Province's Economic

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The triple bottom line of sustainable development, or the intersection of the environment, society, and governance (ESG), is integrated into the sustainability of blue economy development. There

are a lot of steps that must be taken in order to achieve the blue economy, including: (i) creating policies and regulations that support it; (ii) increasing investment in the sector; (iii) enhancing human potential through education and training; (iv) collaborating between the public, private, and civil society sectors; and (v) monitoring and evaluating the blue economy's implementation. The creation of a blue economy model, which is the sustainable use of marine resources for the rate of economic growth while maintaining the health of marine ecosystems, can be one of the main strategies for sustainable national development in Indonesia. As a powerful nation with territorial waters, Indonesia has the potential to develop its economy through the fisheries and maritime sectors. A wide range of natural resources can be found along the coast of East Java Province, including coral reefs with a total of 70 types of coral that can be found in the waters of the Java Sea and the Madura Strait with moderate to very average cover conditions, and mangrove forests that are dispersed in waters in 14 districts or cities. In addition, 17 regions or cities along the Java Sea coast with favorable conditions have the potential to produce fresh shrimp. As was done symbolically on the island of Gili Ketapang, which is a popular tourist destination and a hub for marine farming. Through a restoration program for 4,005,958 mangroves and the rehabilitation of 36.34 hectares of artificial coral reefs, the Provincial Government of East Java has worked to maintain the mangrove environment. This represents a stride in the direction of a blue economy. By hosting a Mangrove Festival, campaign activities and cooperative mangrove rehabilitation are carried out. It began at the Tunggul Mangrove Park Pasuruan in 2019, at the Sampang Police Station in 2020, on the island of Lusi Sidoarjo in 2021, and at the mangrove forest of Cengkrong Trenggalek in 2023. Four guiding principles are used to develop the blue economy in Surabaya: (i) the region's strength and potential; (ii) the added value of mangrove ecosystems that can support the development of coastal areas; (iii) empowerment, which aims to strengthen the community's economy on a micro level and (iv) the principle of sustainability, which states that developing coastal areas must take into account economic, ecological, and social factors. Campaigns for mangrove rehabilitation are also being carried out in conjunction with all facets of society. Holding a Mangrove Festival is one of the collaborative campaign initiatives for mangrove rehabilitation.

Teyeng Batik: A New Innovation for Making Motifs on Batik Using Iron Rust Stains

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Items made of iron that have been left unattended or neglected for years will usually have a reddish-brown surface. This is a sign that the iron has rusted. Rust on iron is formed due to a reaction between iron and oxygen in the presence of water or moisture in the air. This rusting process is known as the oxidation process. The reddish-brown color is the result of an oxidation process with the scientific name of iron oxide (Fe_2O_3). Batik is a pictorial fabric, and the process of making it is specifically done by drawing or applying motifs to a plain or blank cloth, then carrying out a special process so that the cloth has special characteristics, compared to other fabrics. Indonesian batik has many kinds of motifs, ranging from motifs shaped like animals to clouds and statues. Each variety of Indonesian batik motifs has its own meaning and uniqueness. Batik is an Indonesian cultural icon. Batik is made with a variety of different techniques. Several types of batik, according to the manufacturing technique, include written batik, stamped batik, painted batik, jumputan batik, combination batik, printed batik, and Teyeng batik. Teyeng batik is a new innovation in making motifs on batik using iron rust stains. The rusting process is intended

to give a rust pattern to the plain cloth to be used as batik. This process forms the basic motifs of batik cloth. To create rust stains on batik cloth, iron and wire are used, such as scrap iron trellis, ram wire, gabion wire, or other similar materials. The shape of the wire used and the way it is arranged on the cloth will make the rust motifs different from one another. Rust stains resulting from the trellis will form straight lines, like connecting lines. Rust stains from granulated iron and ram wire will give fabrics a dirty or old appearance and leave small squares of stains. Stains from the gabion wire will produce an irregular diamond-shaped pattern like snake scales. The stages for making Teyeng batik consist of preparing the fabric material, the rusting process, making batik motifs, batik dyeing, drying the cloth, generating the batik colors, batik fabric fixation, removing the wax, rewashing the batik fabric, and folding the batik fabric.

Dielectric Characteristics of the $(1 - x - y)BiFeO_3 - yBaTiO_3 - xPbTiO_3$ Ceramics

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Ceramics of ternary systems solid solutions $(1 - x - y)BiFeO_3 - yBaTiO_3 - xPbTiO_3$ ($0.1 \le y \le 0.2$, $\Delta y = 0.025$, $x = 0.5$) were prepared by the solid-phase reactions technique with subsequent sintering, using conventional ceramic technology. Previously, only the concentration range near the morphotropic phase boundary region was studied for this system [1, 2]. We found sharp maxima on the dependences $\varepsilon'/\varepsilon_0(T)$ appear at temperatures around 500°C (see Fig. 1). They relate to the phase transition from the ferroelectric to the paraelectric phase. An increase in the concentration of barium titanate leads to a shift in the temperature of the phase transition to the low-temperature region. Comparison of forward and reverse permittivity did not reveal hysteresis phenomena. The permittivity values for a sample with $y = 0.2$ are much higher than in other samples. The reason for such abnormal dielectric characteristics will be the subject of further research.

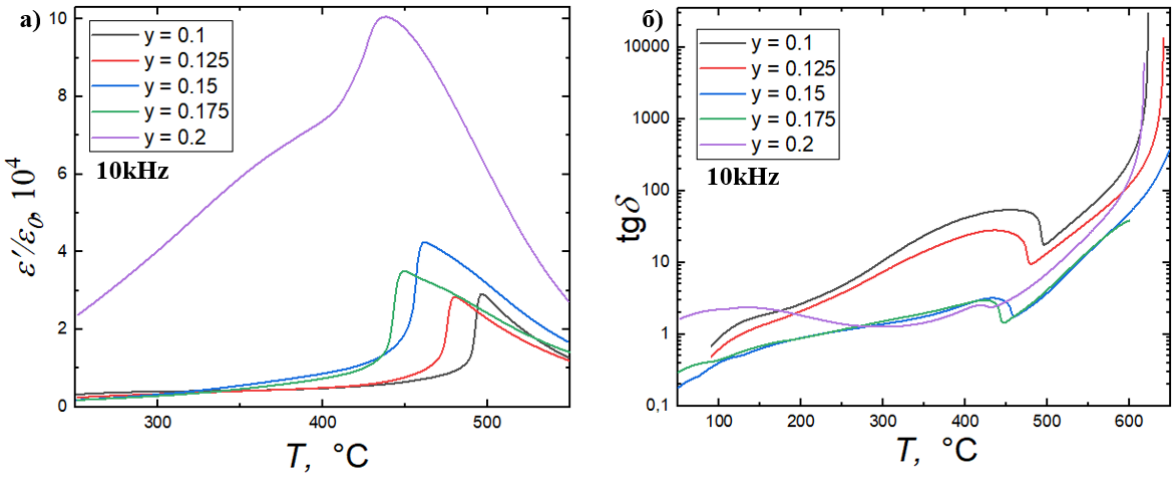

Fig. 1. Temperature dependences of $\varepsilon'/\varepsilon_0$ and loss tanδ in the $(1 - x - y)BiFeO_3 - yBaTiO_3 - xPbTiO_3$ ($0.1 \le y \le 0.2$, $x = 0.5$) ceramics

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The Role of AutoCAD Software in Industrial Engineering

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Along with the times, the world of education is not spared from the world of information and technology, which play an important role in the development of the world of education. In addition, technology also helps accelerate the completion of a job, including in engineering. Computer programming is used in drawing techniques, one of which is the AutoCAD program. AutoCAD is computer software used to draw in either 2 or 3 dimensions. Autocad is an acronym of the word "automatic computer-aided design. Autocad was first introduced in 1982 by Autodesk Inc. under the name MicroCAd; it was perfected by releasing Autocad version 10 and began to develop in the same Windows version as the latest. Currently, Autocad is widely used to develop product design, and many industries are trying to develop their products by slightly modifying old ones into new ones. Autocad provides a lot of accuracy, speed, and ease of use, with a level of drawing accuracy reaching 16 decimals and the ability to design very precise sizes even with submicron sizes. AutoCAD is also a vector-based tool, and this technique allows every model that you have made to enlarge or reduce in scale, which will not affect the quality of the resulting image. With lightweight interphase and easy operation, AutoCAD is the best-known and most widely used CAD software worldwide.

Productivity Calculation Analysis Using Mundel Method (Case Study: Pt. Multi Jaya Glass)

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Multi Jaya Glass Company is a company engaged in glass production. The company produces glass for building windows, house windows, and other construction purposes. The Multi Jaya Glass Company calculates their production using the Mundel approach to find out if the company's production is correct or there are still many deficiencies. The Marvin E. Mundel method is one of

the productivity measurements. Total productivity in monitoring productivity, namely the ratio between output and input data. The output data are in the form of acceptance (revenues) while input data are in the form of production resources. Production resources can include work equipment, labour, energy consumption and production costs. Acceptance can be in the form of products manufactured. This method is used for a measurement of the company's productivity level by focusing on production costs as input data and products manufactured as output data. Increased productivity is attained by utilizing production resources optimally. The low productivity level is caused by an increase in production costs in connection with the constraints encountered by the company such as decreased performance. The purpose of this study was to analyse the level of productivity of flat glass as raw material for construction glass, to identify the factors, causing a decreased productivity, in order to obtain the input and output data, that cause the decrease. Data, relating to IP Labour, have increased by 4%, to IP Direct Labor Costs have increased by 64.4%, to IP Capital Depreciation have increased by 90%, to IP Book Value of Capital have decreased by 14.9%, to IP Direct Total Cost have demonstrated an increase of 62.82%, to IP Overall Cost have showed an increase of 85.38%, to Fixed Energy IP had 0%, to Material IP have demonstrated an increase of 18.04%.

Productivity Analysis Using OMAX Method (Case Study: Pt. Sumber Bhakti)

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PT. Sumber Bhakti is a company, engaged in the production of steel for construction. The company produces steel for construction purposes in the construction of houses, roads, buildings and other construction needs. The Sumber Bhakti company calculates its production using the Objective Matrix (OMAX) approach to determine the productivity index in the company. The OMAX method is an approach, used to identify, classify, and evaluate various objectives to be achieved in a particular project, organization, or situation. This method helps in formulating clear and measurable goals and developing strategies to achieve them. The OMAX method usually involves the use of a two-dimensional matrix, consisting of rows and columns. On the line, the goals or objectives achieved are placed in the form of a specific statements. While in the column, the relevant criteria or factors to evaluate and measure the achievement of these objectives are placed. The purpose of this research is to analyze the level of productivity of construction steel as a raw material for building construction, to identify productivity that has increased in certain periods. To get previous data, we enter some of the data criteria tested or data processing along with the time period. Data, indicating input criteria: raw materials (1), labor (2), machinery (3), energy consumption (4), and capital (5). After processing the data, it shows the results of increasing performance, namely index of productivity (IP) for each period: IP = 1.40 for February, IP = 0.11 for May, IP = 0.37 for July, IP = 1.87 for September, IP = 1.06 for February, IP = 0.19 for March, IP = 1.75 for May.

Optimizing Efficiency and Effectiveness in Industrial Management: Strategies and Insights

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Efficiency and effectiveness are crucial aspects of industrial management that significantly impact the success and competitiveness of organizations. To optimize these factors, strategic planning and innovative approaches are required. This study aims to explore strategies and insights for enhancing efficiency and effectiveness in industrial management. This study utilizes a comprehensive literature review approach, drawing on relevant scholarly works and practical examples. The review includes seminal books and academic articles on operations and supply chain management, strategic management, and organizational capabilities. The research also incorporates case studies conducted in Indonesia, such as the performance evaluation of large and medium-scale manufacturing industry clusters in East Java Province and the performance evaluation using PCA and DEA for micro and small manufacturing industries. The discussion highlights the importance of operational excellence in industrial management, focusing on the alignment of operational activities with strategic objectives and the adoption of lean principles. It also explores the utilization of advanced technologies like automation and data analytics to enhance productivity and minimize waste. The formulation and execution of effective strategies are discussed, emphasizing the analysis of internal and external environments and the integration of innovation and risk management. The significance of leadership, organizational culture, and employee empowerment is explored, emphasizing the role of a learning organization in driving operational excellence. Efficiency and effectiveness in industrial management can be achieved through a multidimensional approach that incorporates strategic planning, operational optimization, and leadership development. By aligning operational activities with strategic objectives, adopting lean principles, leveraging advanced technologies, and fostering a culture of continuous improvement, organizations can enhance productivity, reduce costs, and achieve operational excellence. Further research and case studies are needed to validate and expand upon the findings in different industrial contexts.

Simultaneous Analysis of the Monetary Sector in Indonesia (Mundell – Fleming Partial Approach)

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Monetary policy is one of the government's efforts to control macroeconomic conditions. Changes in monetary policy will affect other economic variables. This study aims to simultaneously analyse monetary policy shocks in the open economy using Indonesian monthly data for the period January 2000 – August 2019 by using a partial approach to the Mundell-Fleming theory. The method, used in this study is Two-Stage Least Square. The results obtained indicate that: (i) the shock of monetary policy on economic variables indicates phenomenon of puzzle or does not accord to theory and (ii) contribution of Indonesia Bank rate is the biggest to the price variable (inflation).

This study uses a partial IS-LM model from the LM side. The results showed that there was a simultaneous relationship between the endogenous variables of the interest rate equation and inflation. From the interest rate equation model, all variables have a significant effect on the interest rate, except for the world oil price, negative relationship is shown by money demand, national income and inflation. Meanwhile, in the inflation equation, only the national income variable is insignificant, a negative relationship is shown by national income and net foreign assets.

Cluster Development of Small and Medium Manufactures in Surabaya City, East Java, Indonesia: Across the Limits of Time and Spaces

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Museums hold a captivating power, transporting us to different eras, cultures, and realms of knowledge. This report delves into the essence of museums, highlighting their significance as repositories of human history, art, and scientific achievements. By employing the language of humans, this piece aims to evoke the enchantment that museums cast upon visitors and shed light on their multifaceted role in society. Museums are sanctuaries of learning, fostering intellectual curiosity and promoting the preservation of our collective heritage. These institutions provide a tangible link to the past, enabling individuals to connect with the stories, experiences, and triumphs of those who came before us. Through carefully curated exhibits and artifacts, museums offer a vivid glimpse into historical events, igniting our imaginations and stimulating a sense of wonder. Artistic treasures grace the walls of art museums, capturing the creativity, emotions, and perspectives of countless generations. From awe-inspiring masterpieces to experimental contemporary works, these collections reflect the diversity and evolution of human expression. The visual symphony of colours, textures, and techniques invites us to contemplate the universal language of art and immerse ourselves in the boundless dimensions of human creativity. Moreover, museums serve as catalysts for cultural exchange, bridging the gaps between different societies and fostering empathy and understanding. By showcasing the traditions, customs, and beliefs of diverse civilizations, museums promote dialogue and facilitate a deeper appreciation for cultural diversity. They invite us to celebrate our shared humanity while embracing the beauty of our differences. In conclusion, museums are more than mere repositories of artifacts; they are gateways to a world of discovery, inspiration, and reflection. They allow us to transcend the boundaries of time and space, transporting us to ancient civilizations, artistic movements, and scientific breakthroughs. As we step into these hallowed halls, we embark on a journey of exploration, expanding our horizons and enriching our understanding of ourselves and the world around us. Museums truly embody the essence of human ingenuity, nurturing our collective memory and inspiring future generations to dream, create, and shape the course of history.

Measurement of Company Productivity PT. Silver Box with the Objective Matric Method (OMAX)

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Productivity is one of the factors that greatly influences the performance of an industry. In 2021, PT. Box Silver, producing various souvenir boxes and toys for wooden decorations for souvenirs or decorations, had difficulty achieving its production target, when compared to previous years. This condition causes the overall productivity to experience a very drastic decline. This study aims to evaluate the decline in productivity by measuring the value of productivity, based on 7 criteria, namely labour criteria (wages and salaries), material criteria (raw materials), capital criteria, energy criteria, workforce skills criteria, technology feature criteria, criteria production criteria. A period of 15 months from January 2021 to the March 2022. The method used is the Objective Matrix (OMAX) method, with the steps of compilation of criteria, calculation of ratios and interpolation of matrix values, setting targets, compilation of weights and formation of matrices. The results of this study indicate that the productivity index, obtained at the beginning of the period, is 6.67. The highest productivity value of 9.93 took place in March 2021 and the lowest productivity equal to 0.27 was in January 2022. The value of capital modification showed substandard performance. The expertise of the Serita workforce skills is good or can be said to be above standard.

Partial Productivity Measurement with the Mundel Method

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This research was conducted at UD. Mak Enak. UD. Mak Enak is a production place for various types of dry bread, which are produced every day. The purpose of this calculation is to measure productivity partially based on the output/input ratio approach. Partial productivity is the ratio of output to one of the input factors, used in production. Generally, inputs are divided into four groups, namely material, energy, labour, and capital. In this study there are eleven inputs: labour input (wages and salaries), material input (raw materials), capital input, energy input, skilled labour input, technology input, production equipment input, HR input, managerial input, personal quality input, and miscellaneous input. From the results of the study, it was concluded that labour productivity increased by 6 % and HR productivity increased by 1%. The results of the five causes test stated that the root cause of the decline was an increase in input. The results of the different tests stated that the Mundel model productivity index method was easier to use.

Measurement of Productivity by Marvin E. Mundel Method

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Transformer products are electromagnet components that can change something voltage and one of the main products produced. The production rate of the product very high due to the large amount of consumer demands, originating from abroad, thus encouraging companies to always maintain consumer satisfaction in terms of the quality of the products produced and the timeliness of completion of production. Productivity is the ratio of output to input. Output can be in the form of goods or services, produced by a company, while input is in the form of resources such as work tools, number of workers, raw materials, and production costs. The Marvin E. Mundel method is suitable for companies, whose production processes can be directly observed, their output and input are expressed in aggregate, the company being measured is required to have a standard time to work such as a job order company. This method focuses on production results as output and labour hours, labour costs, capital depreciation, book value of capital, direct total costs, overall total costs, energy used, materials used, maintenance costs, water used, promotion costs as input with the measurement period from November 2021 to December 2022. So that the productivity index values were obtained, including a decrease in the productivity index of 11.12 %, an increase in the direct labour cost productivity index of 5.94 %, an increase in the productivity index of capital depreciation of 14.28 %, a decrease in the productivity index of the book value of capital by 33.34 %, an increase in the productivity index of total direct costs of 5.26 %, an increase in the overall cost productivity index of 0.62 %, an increase in the energy productivity index of 11.11 %, a decrease in the productivity index materials by 7.7 %, the maintenance cost productivity index decreased by 11.12%, the water productivity index decreased by 11.12 %, and finally the promotion cost productivity index increased by 16.66 %.

Automated System for Telemetry of Operating Parameters of a Gas Control Station

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A gas control point is an object of a gas distribution network that performs the function of regulating gas pressure in the network. The gas control station includes gas control devices, instruments and automation that provide control over gas parameters and its safe use [1]. Gas control points are the main element of the entire gas distribution system, ensure reliable and safe operation of the gas network, and are also necessary to provide consumers with gas in the required quantities and quality [2]. Telemetry of operating parameters of a gas control point is a system for automatic collection and transmission of data on the status of all installations and devices, associated with gas control in this point [3]. At the heart of the telemetry system, there are sensors that monitor parameters such as gas pressure, temperature, flow and other characteristics. The collected data are transmitted to the central computer, where it is processed and displayed on the monitor screen. This allows operators to monitor the operation of the point online, quickly detect

malfunctions and prevent emergencies. In addition, the system allows one to analyze the performance of installations and optimize their operation to save resources [4]. One of the main advantages of telemetry is the possibility of remote control of gas regulation. Operators can change the operating parameters of installations and devices without having them physically on site, which significantly increases the efficiency and cost-effectiveness of the site.

Thus, the telemetry of operating parameters of a cabinet gas control station is an important mechanism for ensuring the safety and efficiency of installations. It allows operators to quickly respond to possible problems and control the operation of devices remotely [5].

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Proposed Strategy for Increasing Productivity Based on the Results of Objective Matrix (OMAX) Measurement Analysis in the Transformer Production Department at PT. Netsle Indonesia Manufacture

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Growth in the number of requests and the demands of maintaining good product quality remains a challenge for PT. Netsle Indonesia to compete in the world of manufacturing. It is necessary for the production and productivity measurements, proposed in the strategy of increased productivity in future. Productivity measurement models in the PT. Netsle Indonesia uses the Objective Matrix (OMAX) model with criteria that measured productivity as the ratio of hours worked utilities, electrical energy consumption, utility workers, defective product ratio, the ratio of good products, and the ratio of engine damage. OMAX shows that the ratio of hours worked utilities is the dominant criterion value productivity is lesser standard one. The ratio will be analyzed using the Logic Tree Diagram for the proposed strategy to obtain an increase in productivity.

Mpu Tantular Museum as a Cultural Heritage Tourism Attraction in East Java

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This Final Project Report examines the tourism potential of the East Java Mpu Tantular State Museum. The purpose of this research is to find out the history, the potential possessed, and the development carried out by related agencies towards the potential progress of the East Java Mpu Tantular State Museum as an attractive tourist object for visits. The writing of this report is presented in a qualitative descriptive manner to obtain various descriptions of information relating to the tourism potential of the Mpu Tantular State Museum, East Java. The method used in writing this report is to use observation, interviews, literature study. The data obtained were then analyzed qualitatively and presented descriptively. The results showed that the tourism object of the Mpu Tantular State Museum, East Java, has enormous potential for tourism in Sidoarjo Regency. The potential possessed by the tourist object of the Mpu Tantular State Museum in East Java is as a place for recreation, research and education. Existing tourist facilities and infrastructure still need to be further developed to make visitors comfortable and feel at home when visiting the Museum. The conclusion that can be drawn is that the tourism object of the Mpu Tantular State Museum in East Java has the potential to be a very interesting tourist object to visit. Development efforts through various events including exhibitions and traveling museums and other events have been carried out by the Museum management, which aims to introduce the tourist object of the East Java Mpu Tantular State Museum.

The Role of Technical Drawings in the Industrial World

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Engineering drawings are drawings that consist of several symbols, lines, and upright writing that is firm in its reading. Technical drawings are commonly used to provide a complete explanation of an object based on provisions and technical standards that have been agreed upon by standardization bodies, both national and international. A technical drawing related to engineering is also called a technical drawing. Currently, the standard bodies that we often hear about and use include the Japanese Industrial Standard (JIS), which is a Japanese standardization body, and the International Organization for Standardization (ISO), which is an international standardization body based in Geneva, Switzerland. The most widely used standard in the world is ISO. Meanwhile, the standardization in Indonesia is SNI, which is the Indonesian national standard. Engineering drawings function as images that contain all the technical information about an object. Its function is to explain the technical data that includes the size and dimensions of objects, the visualization of an object, the material used, the flow of a work process, and so forth, which serves to facilitate the process of making an object, a project, or a construction. Engineering drawings are usually found in many mechanical, electrical, architectural, and instrument drawings, as well as many others related to engineering.

Simulation of the Complex Oxide Crystal Structure with the Use of Interatomic Bond Characteristics

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The families of complex perovskite-type oxides with various structures, including perovskite (binary ABO_3 or ternary), perovskite-type layered ($A_{m-1}Bi_2B_mO_{3m+3}$), pyrochlore (binary, $A_2B_2O_7$, ternary or quadruple) and KW-bronze structures, are the largest among oxygen-octahedral structure-types by the number of well-known ferroelectrics and other relatives. The given report is dedicated to solution of problem of existence of similar complex oxides. For this purpose, some parameters of crystalline structure and atom composition characteristics are *a priori* determined. The following characteristics may be chosen for this reason: interatomic bond lengths (unstrained and strained), and their strains too in structure of complex oxides. Designed procedures of such a theoretical crystal structure details definition [1] for oxygen-octahedral structures are shown.

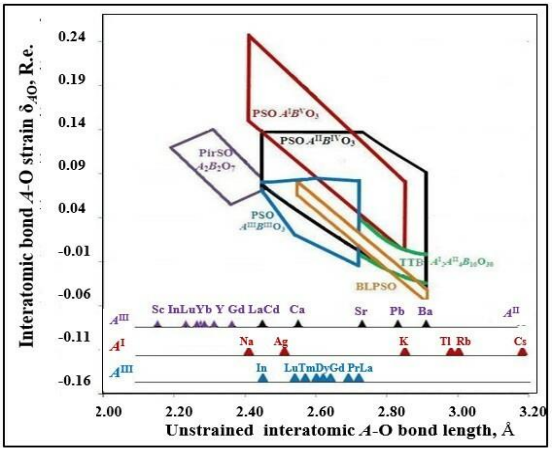

Fig. 1. Schematic bounds of EAs of the complex oxides with different perovskite-type structure composition types: $A^IB^VO_3$ (red bounds), $A^{II}B^{IV}O_3$ (black bounds) and $A^{III}B^{III}O_3$ (blue bounds), pyrochlore $A^{III}_2B^{IV}_2O_7$ (violet bounds), Bi-containing layered perovskite-like (orange bounds)

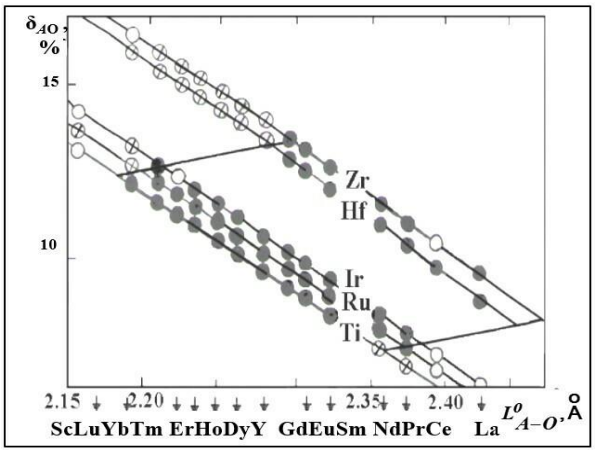

Fig. 2. Pyrochlore structure EA for composition $A^{III}_2B^{IV}_2O_7$: painted circles denote known pyrochlores, empty circles denote hypothetical compounds, and crossed-out circles denote compounds that do not crystallize in the structure; EA is highlighted by thick bounds

They allow one to calculate with the use of quasi-elastic structure models *a priori* cell parameters and interatomic bond characteristics, and to construct the existence areas (EAs) of different structures with these interatomic bond parameters. The established regularities would allow us to predict forming the structure of compound with specified composition. Developed regularities allowed us to construct EAs of perovskite-like structures on diagrams (L^o_{A-O}, δ_{AO}) (Fig. 1), find their boundary equations and then to develop the procedure of directed search for new oxides with specified composition and structure [1] as well as properties [2]. Using these boundary equations, one may predict the forming of specific structure type by computation of expected δ_{AO} in the hypothetical oxides. If these values do not pass through boundary of EA of structure, then the oxide must appear in it under the conditions for oxidation degrees keeping. Otherwise, it cannot crystallize in the specified structure. EAs (for example, Fig. 2) were constructed for all structure-types under consideration.

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Change in Different Phase Transitions Temperatures of Binary Perovskites with a Change in Their Interatomic Bond Strains

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The binary oxides ABO_3 with perovskite structure, possessing the consecutive phase transitions (PTs): ferro- (FE) or antiferroelectric (AFE) at Curie temperature T_C, and magnetic ones at Neel temperature T_N; multiferroics (MFs); classical FEs and AFEs without any magnetic PTs are considered. The goal is to determine, what extent the areas of change in their interatomic bonds A – O strains, δ_{AO}, calculated with use of quasi-elastic perovskite structure, proposed of Sakhnenko model are separated from each other together with their different PTs temperatures and their differences $T_C - T_N$, or how they overlap with each other.

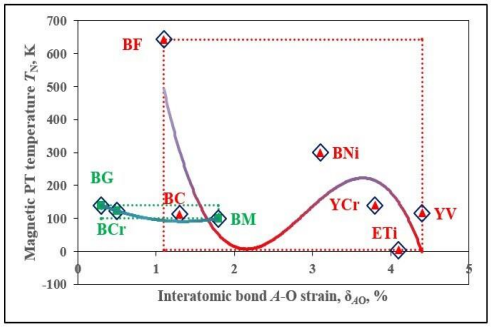

Fig. 1. Changes of rectangular areas (*dotted lines*) of T_N for MFs with FE (*triangles inside in rhombuses*) and AFE PTs (*squares inside in rhombuses*), according with a change in their δ_{AO} values together with dependences $T_C(\delta_{AO})$ inside

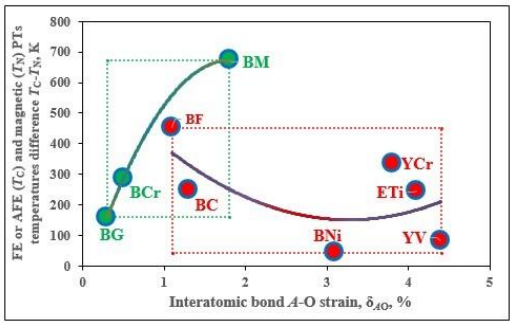

Fig. 2. Changes of rectangular areas of $T_C - T_N$ for MFs with FE and AFE PTs and according with a change in their δ_{AO} values together with dependences $T_C(\delta_{AO})$ inside these areas

We have constructed [1] the correlations between the interatomic bonds A – O strains, δ_{AO}, and temperatures T_C of classical binary FE and AFE perovskites without any magnetic PTs. Then have been constructed [2] correlations between the δ_{AO} values and the FE or AFE (T_C) as well as the constructed here correlations between magnetic PTs, T_N, of MFs and their δ_{AO} values (see, Figure 1). Constructed here correlations show (Figure 2), that the different PTs temperatures and difference between them, $T_C - T_N$, of binary MFs depend in a certain way on the δ_{AO} values. Then we moved to considering of solid solutions between different perovskites [3]. Some generalized diagrams of relationships between the δ_{AO} values and the FE and AFE PTs temperatures, together with the corresponding magnetic PTs and their difference $T_C - T_N$, were obtained. Thus, "power" of the applied structural parameter, the strain of the weakest interatomic bond A – O in the perovskite structure for study the general relationships “composition – structure – properties” in [4] and once again here was shown.

Acknowledgement. This study was financially supported by the Ministry of Science and Higher Education of the Russian Federation (State assignment in the field of scientific activity, Southern Federal University, 2023, Project No. FENW-2023-0015).

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Modeling of the Propagation of Surface Plasmon Polaritons

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In this report, we study a system of two related nonlinear Schrödinger equations for complex-valued functions u and v:

$$iu_t+\frac{1}{2\beta}u_{yy}+ilu+kv=0,\quad iv_t+\frac{1}{2\beta}v_{yy}+i(l-g)u+\gamma|v|^2v+ku=0,$$
$$u\left(-\frac{d}{2}+y,t\right)=u\left(\frac{d}{2}+y,t\right),\ v\left(-\frac{d}{2}+y,t\right)=v\left(\frac{d}{2}+y,t\right), \qquad (1)$$
$$u(y,0)=u_0(y),\ v(y,0)=v_0(y),$$

where $u(y,t)$, $v(y,t)$ are the desired functions, the parameters l, g, k are normalized coefficients of loss, gain and coupling; $\gamma=\gamma_1+i\gamma_2$ is a Kerr nonlinearity parameter. The substitutions

$$u(y,t)=q(\xi,t)e^{i\frac{2\pi n}{d}y}e^{-\frac{i}{2\beta}\left(\frac{2\pi n}{d}\right)^2t},\ v(\xi,t)=w(y,t)e^{i\frac{2\pi n}{d}y}e^{-\frac{i}{2\beta}\left(\frac{2\pi n}{d}\right)^2t},\ \xi=y-\frac{1}{\beta}\frac{2\pi n}{d}t$$

leads (1) to a system of the same kind:

$$q_t-\frac{i}{2\beta}q_{\xi\xi}+lq-ikw=0,\quad w_t-\frac{i}{2\beta}w_{\xi\xi}+(l-q)w-i\gamma|w|^2w-ikq=0.$$

This makes it possible to study the stability of traveling waves, based on the stability of the thermodynamic branch: $u_0(t)=ae^{\omega_0 t}$, $v_0(t)=be^{\omega_0 t}$, $a=\dfrac{ikb}{i\omega_0+l}$,

$|b|^2=\dfrac{l^2-\omega_0^2-gl+k^2}{-\gamma_1\omega_0-\gamma_2 l}=\dfrac{2l\omega_0-g\omega_0}{\gamma_1 l-\gamma_2\omega_0}$, where it is satisfied the cubic equation:

$$\gamma_2\omega^3-\gamma_1(g-l)\omega^2+\gamma_2(l^2-k^2)\omega-\gamma_1 l[(g-l)l-k^2]=0.$$

For example, when $\gamma_1=3.5\cdot10^{-3}$, $\gamma_2=3.5\cdot10^{-4}$, $l=0.0026$, $k=0.0028$, $g=0.01$, we get $\omega_{1,2}=-0.000034304\pm i\cdot0.00200013$, $\omega_3=0.740686$.

The statements are formulated on the stability (orbital asymptotic stability) and instability of periodic solutions, depending on the parameters of the problem, as well as on the structure of the spectrum for the critical case. Formulae for approximate asymptotic solutions are given. In [1], a numerical scheme for solving (1) was implemented. In [2], surface plasmon-polaritons are interpreted as hybrid waves, caused by the interaction of photons and free electrons at the interface of media. It is shown in [3] that under the influence of Kerr nonlinearity and saturation, the

plasmon flux is self-induced. The period and profile of the envelope of an excited nonlinear wave vary, depending on the excitation conditions and energy density. The specificity of the model in the form of a system of Equations (1) makes its own adjustments.

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Experimental Investigation of Bandgaps in Two-layered Acoustic Metamaterials with Arrays of Strip-like Cracks

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The application of artificial periodic composite structures has a great potential in the development of transducers, sensors as well as smart systems and structures for active noise reduction, adaptive optics, energy harvesting, etc. Novel acoustic metamaterials with multiple arrays of strip-like cracks as proposed in [1] provide wide band-gaps, where propagation of elastic waves is forbidden.

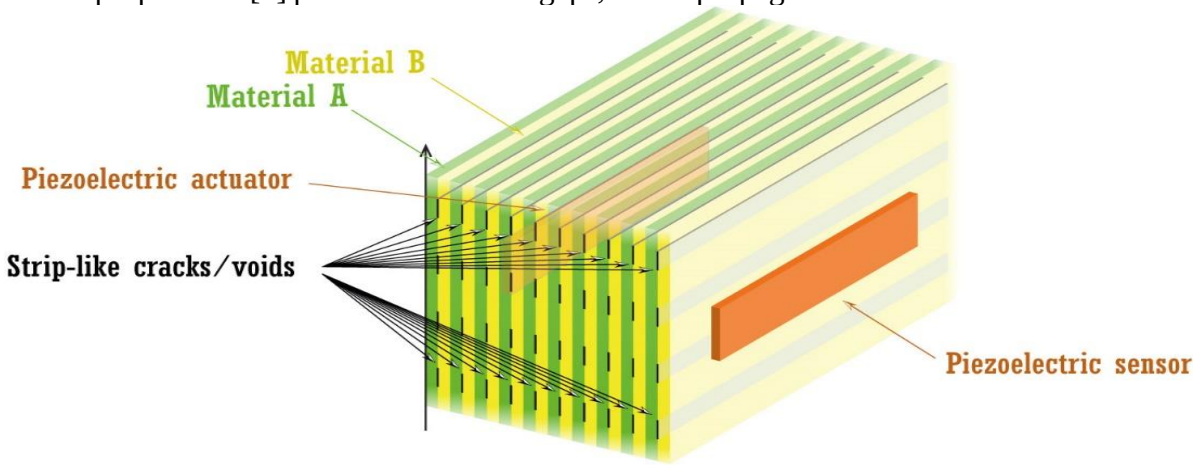

Fig. 1. Example of a sample of multi-layered acoustic metamaterial with arrays of interfacial crack-like voids with two mounted piezoelectric transducers (actuator and sensor)

The goals of the present study are the manufacturing of these acoustic metamaterials and the experimental investigation of wave propagation in such periodic structures. Several samples of acoustic metamaterials have been manufactured on a dual extruder 3D printer since the dissimilar components do not demand additional bonding and have been fused by a heated extruder during printing [2]. Wave motion in the samples of acoustic metamaterials with multiple arrays of thin voids made using additive technologies is generated and sensed by rectangular piezoelectric transducers, glued at the two opposite surfaces (see Fig. 1). The transmission coefficients, calculated from the sensor measurements, show the formation of bandgaps in the manufactured specimens.

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Specific Heat Capacity of Light Rare-Gas Crystals in the Model of Deformable Atoms

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Rare-gas crystals (RGC) (except for He) form an FCC-structure with one atom in the unit cell. They are the simplest molecular crystals that are held together by relatively weak van der Waals forces. Based on the non-empirical version of the quantum mechanical model of deformable and polarizable atoms, a dynamic matrix was constructed, taking into account the three-body interaction, both due to the overlap of electron shells and due to their deformation. This made it possible to calculate phonon frequencies for RGC at the required points of the Brillouin zone and, using the Chadi-Cohen method, the specific heat capacity C_V of compressed FCC-Ne and FCC-Ar in a wide pressure range. A study was made of the effect of three-body interaction on the specific heat capacity in the short-range repulsion potential and deformation of the electron shells of atoms in the pair and three-body approximations in a wide pressure range and temperature range. Unfortunately, at present, we know the experimental data on the specific heat capacity only at zero pressure. Specific heat capacity calculations showed that the relative error of our results with experimental data decreases with increasing temperature. Comparing the average errors of the calculated models and experiment, it can be seen that the contribution of deformation in the pair approximation reduces the error by 0.13% for Ne and by 0.04% for Ar. The three-body interaction, associated with the overlap of electron shells, reduces the error by 0.13% for Ne and by 0.07% for Ar. The contribution of three-body forces, both due to overlap and due to deformation, reduces the error by 9% and 2% for Ne and Ar, respectively. In more detail, the influence of the three-body interaction and deformation of the electron shells of an atom in pair and three-body approximations was shown by a quantitative analysis of the average value of the specific heat capacity (at temperatures from 25 K to 400 K) in the compression range from 0 to 0.7 (p = 169.6 GPa) for Ne and from 0 to 0.6 (p = 97.9 GPa) for Ar. It was found that the contribution of the deformation of dipole-type electron shells in the pair and three-body approximations increases from 0.03 % to 6.6 % in Ne and from 0.08 % to 7.7 % in Ar, the contribution of three-body forces, associated with the overlap of electron shells, increases from 1 % to 3 % in Ne and from 1 % to 7.4 % in Ar, and the contribution of both types of three-body forces due to both the overlap and deformation of electron shells is from 1 % to 5.7 % in Ne and from 1.1 % to 12.3 % in Ar.

Bifurcation of Solutions of the Phenomenological Equation of Spin Combustion

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The discovery of non-stationary effects, autooscillating and spin modes of exothermic reaction zone propagation belongs to J. B. Zeldovich, who developed the theory of condensed systems burning [1]. Construction and research on the stability of rotating waves, which are the solution of the boundary value problem of spin burning in the ring of radius: $r_1 < r < r_2$ with the pseudo-differential operator $(-\Delta)^{\alpha}$, $0 < \alpha < 1$, are considered:

$$\ddot{u} + u = 2\varepsilon\left[\dot{u}\left(1 - \frac{4}{3}\dot{u}^2\right) + \frac{\lambda^2}{4\pi^2}\Delta\dot{u} + \frac{\beta\lambda}{2\pi}(-\Delta)^{\alpha}\dot{u}\right], \quad 0 < \alpha < 1,$$
$$u(r, \varphi + 2\pi, t) = u(r, \varphi, t), \quad \frac{\partial\dot{u}}{\partial r}\Big|_{r=r_1, r_2} = 0, \quad u(r, \varphi, 0) = u_0(r, \varphi). \tag{1}$$

Let λ_{nm} are the positive roots of the equation: $J_n'(\mu)Y_n'(\chi\mu) - Y_n'(\mu)J_n'(\chi\mu) = 0$, $\chi = \frac{r_2}{r_1}$, $J_{nm}(r) = \varphi(\lambda_{nm}r)\left\|\varphi(\lambda_{nm}r)\right\|^{-1}$, $\left\|J_{nm}(r)\right\|^2 = \int_{r_1}^{r_2} J_{nm}^2(r)rdr = 1$, $\varphi(\lambda_{nm}r)$ are the solutions of the Sturm – Liouville problem of the Bessel equation with Neumann's conditions. Denote

$$q_{nm}(\rho) = 1 - \rho^{-2}\left(\frac{\lambda_{nm}}{r_1}\right)^2 + \beta\rho^{-1}\left(\frac{\lambda_{nm}}{r_1}\right)^{2\alpha},$$

where $\rho = \frac{2\pi}{\lambda}$ is a bifurcation parameter. If $q_{11}(\rho) < 0$, then the initial solution of the problem (1) is unstable, as a result of the bifurcation of Andronov – Hopf (increasing ρ and passing through ρ_{11}, $\varphi(\rho_{11}) = 0$) two solutions of the rotating wave type, borning from the unstable initial solution. Approximate solutions are built by the Galerkin method in combination with the Krylov – Bogolyubov – Mitropolsky – Samoilenko method [2], [3]:

$$(u_1^s)^{\pm} = \sum_{m=1}^{3} z_{1m}^s J_1\left(r\frac{\lambda_{1m}}{r_1}\right)\cos(t \mp \varphi), \quad s = 1, 2, \tag{2}$$

where $z_{1m}^1 = z_{1m}(\rho)$, $m = 1, 2, 3$. The solutions $(u_1^2)^{\pm}$ are unstable rotating waves that are suppressed by the wave $(u_1^1)^{+}$. The results of the work summarize [2], [3] in the case of a ring.

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Development of a Sensitive Element of a Resistive Gas Sensor Based on Nanostructured Zinc Oxide

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The purpose of this work is to develop a resistive gas sensor, based on nanostructured zinc oxide with admixtures of an additional material. The formation of a sensitive element on a polycor substrate occurs due to the use of the method of low-temperature solid-phase pyrolysis. The resulting device has a small size, low cost, and is also formed using standard microelectronics methods. Today, when the production of microelectronic industry is expanding, the problem of controlling the gas atmosphere and ensuring the safety of labor becomes an urgent task for research [1]. Various gas detectors are being developed for this purpose. One of the most common are resistive type sensors. Various nanoscale structures are used as a sensing element. A promising material is nanostructured zinc oxide with the necessary level of additional material, which leads to an improvement in the gas-sensitive characteristics of the detector [2]. The sensing element was formed on a polycor substrate using the method of low-temperature solid-phase pyrolysis. Tin oxide was used as an additional material to zinc oxide. Nanostructuring was carried out by plasma chemical treatment methods. Gas detection occurs when gas molecules begin to interact with the developed surface of the gas-sensitive layer, as a result of which the concentration of the main charge carriers changes. The resistive sensor created by this method is characterized by small weight and size parameters, low cost, as well as the use of standard microelectronics methods, which distinguishes it favorably from competing devices.

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Dependence of Optical and Mechanical Properties of Polysilicon on Isolator on Formation Conditions

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Many elements and devices of microelectromechanical and microoptoelectro-mechanical systems (MEMS and MOEMS) are fabricated based on the structure of silicon on insulator by micromachining techniques [1]. It is known that a single-crystal silicon layer can be replaced by a polycrystalline one. At the same time, the ability to manage the properties of layers in such structure allows one to expand the functionality of the final device. The purpose of this work is to study the parameters of polycrystalline silicon on insulator structure formation and to study optical and mechanical properties of the films to create optical elements for MOEMS. Studies were carried out to obtain polysilicon on insulator structures, consisting of layers of silicon dioxide (from 1 to 2 μm thickness) and polycrystalline silicon (several μm thickness). The layers were deposited onto a silicon (100) wafer using plasma-enhanced chemical vapor deposition (PECVD) [2]. By varying the deposition parameters, the physicomechanical and optical properties of the layer materials are changed, which determine the possibility of adjusting the parameters of the optical elements. The layer parameters were studied by atomic force microscopy (roughness), stylus profilometry (stress), and ellipsometry (refractive index). As a result, polysilicon film on plasma oxide insulator film on silicon wafer structures were fabricated with controlled roughness and internal stresses. In this case, the refractive index of silicon oxide and polycrystalline silicon was 1.3 – 1.9 and 3.0 – 4.0, respectively. The subsequent high-temperature treatment will make it possible to further modify the noted material parameters. Based on the results, the modeling of optical elements – metalenses [3] with improved parameters and characteristics was performed.

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Decision-Making under Uncertainty: Strategies for Navigating Ambiguity

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The report considers various approaches and techniques, used in decision-making under uncertainty. It discusses probabilistic modeling, scenario analysis, and sensitivity analysis as methodologies to quantify and assess uncertainties. The report emphasizes the value of these tools in evaluating decision alternatives, identifying potential risks, and uncovering hidden opportunities. Then, it addresses the role of decision support systems and advanced analytics to enhancing decision-making under uncertainty. It highlights the integration of data-driven approaches, machine learning algorithms, and optimization techniques to improve decision accuracy and robustness. Ethical considerations are also addressed, emphasizing the need for responsible decision-making under uncertainty. It highlights the importance of transparency, fairness, and accountability in addressing uncertainties that may have ethical implications. It underscores the significance of ethical frameworks and stakeholder engagement to ensure ethical decision outcomes. The report is concluded by highlighting the outcomes and benefits of effective decision-making under uncertainty. It emphasizes the importance of adaptive strategies, continuous evaluation, and learning from past decisions. The value of employing sound decision-making practices to mitigate risks, seize opportunities, and achieve desired outcomes in uncertain environments is pointed. In summary, it is provided insight into decision-making under uncertainty. By exploring strategies, methodologies, technological advancements, and ethical considerations, the report aims to empower decision-makers with the tools and knowledge needed to navigate ambiguity effectively. By embracing robust strategies and leveraging advanced analytics, decision-makers can make informed choices, adapt changing circumstances, and drive positive outcomes despite of the inherent challenges posed by uncertainty.

Mundel: Understanding the Dynamics of a Complex System

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Mundel is a concept that refers to the study of complex systems and their dynamic behavior. It encompasses a broad range of disciplines, including physics, biology, sociology, and economics. This report provides an overview of the key aspects and significance of Mundel as an interdisciplinary approach to understanding complex systems. Firstly, the report highlights the fundamental principles underlying Mundel. Complex systems are characterized by their interconnectedness, nonlinear interactions, and emergent properties that cannot be predicted by studying individual components in isolation. Mundel seeks to unravel the underlying patterns, behaviors, and mechanisms that arise from the collective interactions of the system's components. The abstract further emphasizes the applications and relevance of Mundel in various fields. In physics, Mundel aids in comprehending phenomena like self-organization, phase transitions, and chaos theory. In biology, Mundel provides insights into biological networks, ecosystem dynamics, and evolutionary processes. In sociology, Mundel elucidates social networks, opinion dynamics,

and cultural evolution. In economics, Mundel assists in understanding market dynamics, financial networks, and macroeconomic stability. Furthermore, the abstract highlights the methodologies and tools, employed in Mundel research. Computational modeling, network analysis, statistical methods, and data-driven approaches are utilized to simulate, analyze, and predict the behavior of complex systems. These techniques enable researchers to gain a deeper understanding of the underlying dynamics and to make informed decisions and policy recommendations. The abstract concludes by emphasizing the importance of interdisciplinary collaboration in Mundel research. Given the inherent complexity of real-world systems, the integration of expertise from diverse fields is crucial for addressing complex challenges and developing innovative solutions. In summary, Mundel is a comprehensive interdisciplinary approach that explores the dynamics of complex systems. By uncovering the fundamental principles, applications, methodologies, and collaborative nature of Mundel, researchers can gain valuable insights into the intricate behaviors, exhibited by various complex systems across different domains.

Unleashing the Power of OMAX: Exploring the Capabilities and Applications of a Cutting-Edge Material

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OMAX is a revolutionary material that has attracted significant attention in recent years due to its exceptional properties and diverse applications. This report provides a comprehensive exploration of OMAX, focusing on its unique characteristics, manufacturing techniques, and the wide range of industries where it finds practical use. The report begins by introducing the fundamental properties of OMAX. The report emphasizes the importance of understanding the underlying composition and structure of OMAX to fully exploit its potential. The report highlights the significance of these techniques in harnessing the full capabilities of OMAX for specific applications. The report proceeds to showcase the diverse applications of OMAX across various industries. In aerospace and automotive sectors, OMAX lightweight nature and high strength make it an ideal choice for components such as aircraft parts, car bodies, and engine components. In construction and infrastructure, OMAX durability and resistance to extreme conditions make it suitable for structural elements, bridges, and protective coatings. Additionally, OMAX finds applications in electronics, energy, and biomedical fields, owing to its electrical conductivity, thermal stability, and biocompatibility. Moreover, the report discusses ongoing research and develops efforts to further enhance OMAX properties and expands its applications. It highlights the exploration of OMAX composites, surface modifications, and functional coatings to unlock new possibilities and address specific industry needs. The report is concluded by emphasizing the transformative potential of OMAX and the need for interdisciplinary collaboration among scientists, engineers, and industry experts to continue pushing the boundaries of this remarkable material. By fully understanding and harnessing the capabilities of OMAX, researchers and practitioners can unlock innovative solutions, revolutionize industries, and shape a more sustainable future. By shedding light on the capabilities and potential of OMAX, this article aims to inspire further advancements and utilization of this cutting-edge material across various industries.

Implementation of the Use of AutoCad Applications in Improving Basic Competence in Engineering Drawing for the Community

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With the development of technology, images also experience progress in its use. With the sophistication and advances in technology, it can give birth to a way of drawing using computer media. Technology can help speed up the completion of a job, including CAD (Computer Aided Design) applications. The program that is often used for teaching CAD is AutoCAD, which is an application (software) that is used for drawing, designing drawings, testing materials where the program has the convenience and advantage of making drawings precisely and accurately. Based on field findings, based on direct observation, information was obtained that many of the AutoCAD materials obtained from the previous level was still far from ideal conditions. The AutoCAD material obtained is still a lot about theory and a little practice, hardware devices that are limited to the lack of availability of human resources are common problems that occur. The objectives achieved are the following: (i) improving the quality of training participants through workshops on using AutoCAD applications; (ii) improving the skills of trainees by creating a design project, based on AutoCAD application drawings. The benefits of training activities are: (i) trainees can increase their understanding of the AutoCAD program; (ii) trainees can pass on the knowledge and skills acquired later to those, who need them and especially will greatly assist prospective civil engineers in completing work, related to engineering design; (iii) trainees can design drawings, using the AutoCAD program.

Strategy for Development of Religious Tourism Potentials in Bukit Kasih Kanonang, Minahasa District

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Bukit Kasih in Kanonang Village, West Kawangkoan District, Minahasa Regency, North Sulawesi invites us to live together despite our different ethnicities and religions. The establishment of 6 houses of worship side by side from different religions demands a high sense of solidarity. Bukit Kasih has 6 houses of worship for Catholic, Protestant, Muslim, Hindu, Buddhist and Confucianism. The house of worship was built around 2001, when ethnic and religious clashes occurred in Poso and Ambon. At that time peace was successfully carried out on Bukit Kasih Minahasa North Sulawesi. After peace, a monument of love was built as well as 6 houses of worship. The building is a symbol of peace for all Indonesian citizens with the differences that exist in the country. Then this research complements previous research conducted at the Dutch Peneleh Cemetery in Surabaya in 2019. In this study interviews were conducted with (Bukit Kasih Kanonang Tourism Activists). This research was conducted on 9 May, 2023 and used the legal hermeneutic method. Look directly at the things that are a problem and analyze it according to tourism actions. There are concrete suggestions, namely the participation of the Minahasa Regency Government in reviving local wisdom in Kanonang Bukit Kasih Village; digitization efforts to

attract tourists outside the North Sulawesi Region as well as training in human resources, based on humanist tourism.

Productivity Measurement Using the Marvin E. Mundel Method: A Case Study in the PT. Tjakrindo Mas

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The development of the manufacturing industry requires business actors to continue increasing the competitiveness of the products they produce. A company can compete with other companies, measured by the level of productivity of the company. Measuring productivity can show the results of measuring a performance by paying attention to the resources, used so that efficiency and effectiveness can be achieved. Every company needs to take into account its level of productivity so that it can still compete with other companies. One such a company is a flour company. This company in the previous few years only conducted external and internal audits to see the level of company productivity. In this case, to measure the productivity level of the company, the method used is Marvin E. Mundel. This method focuses on costs with the input data of material costs, labor, capital depreciation, direct labor, book value of capital, direct total costs, overall total costs, energy consumption, maintenance, absenteeism levels and income results as output data with the measuring period January 2023 to February 2023. So that the results of the flour company productivity index were obtained, namely, the labor productivity index has been decreased by 25.9 %, direct labor costs have been increased by 16.3 %, capital depreciation has been increased by 15.5 %, the book value of capital has been decreased by 32.4 %, direct total costs were increased by 68.3 %, overall total costs were increased by 0.9 %, energy consumption was increased by 4.6%, materials were decreased by 9.7 %, maintenance was decreased by 7.69 %, the absentee level was fixed.

Behavior of Magnetic Nanoparticles in the Phantom of the Biological Medium

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There are more and more opportunities to use magnetic nanoparticles (MNPs) in orthopedics to detect, identify, quantify early osteoarthritis and track the effectiveness of treatment, that is theranostics of osteoarthritis. In this work, we study the physicochemical properties of MNPs and the possibility of their detection at localization sites in the biological medium. MNPs were

synthesized in an aqueous medium by chemical co-precipitation (Massard reaction). The main product of the reaction was magnetite Fe_3O_4 nanoparticles, the sizes of which were in the range of 10 – 75 nm. The resulting MNP powder was mixed with microcrystalline cellulose (MCC) powder in a ratio of 3 wt. % MNP and 97 wt. % MCC. Tablets with a diameter of 13 mm and a thickness of 2.5 – 5.2 mm were made from this powder (samples 1). Suspensions were also prepared containing: 3 wt. % MNP and 97 wt. % PMS (liquid polymethylsiloxane with a viscosity of 5 mPa·s, samples 2). Sample 2 was considered a phantom of the biological environment, as their viscosity corresponds to the viscosity of blood and synovial fluid. The magnetic field B was recorded with a Honeywell HMR2300 magnetometer with a resolution of ± 0.1 mgauss. It was assumed that the measured residual magnetic field ΔB correlates with the residual specific magnetic moment p_m. The samples were placed in a constant magnetic field for 1 min and moved to the magnetometer. It has been established that in a weak magnetic field $B \leq 2$ gauss, all samples exhibit the properties of superparamagnetism, and in fields $B \sim 10 – 800$ gauss, hysteresis was observed. After the samples were magnetized in a field of 700 gauss, the following was found:
(i) in samples 1, the residual magnetic field is much less than in samples 2, when the MNP masses in them are practically the same, in particular, 14.2 mg, 50 mgauss and 13.8 mg, 230 mgauss, respectively;
(ii) after vibration impact (2000 rpm) in samples 1 the residual magnetic field practically did not change, and in samples 2 this field decreased by about 2 times;
(iii) the residual magnetic moment in samples 1 was 1.5 – 1.8 times greater than in samples 2, in particular, 0.23 $A \cdot m^2/kg$ and 0.14 $A \cdot m^2/kg$;
(iv) after vibration exposure (2000 rpm for 1 min) in samples 1 the residual magnetic moment practically did not change, and in samples 2, it increased several times;
(v) a relaxation decrease in the values of the residual magnetic field was observed.
The strong influence of vibration exposure on samples 2 is due to the uniform distribution of MNPs in the liquid. The results obtained will be used in theranostics of osteoarthritis, when conducting MNPs in the joint of a biological object.
Acknowledgements. This work is supported by the Ministry of Science and Higher Education of the Russian Federation (MSHE RF) (project No. 075-03-2020-216 of December 27, 2019). Research at Sechenov University in terms of the synthesis of magnetic nanoparticles was carried out with the financial support of the MSVO RF under grant agreement No. 075-15-2021-596.

Superconducting Planar Concentrator in an Ultraweak Magnetic Field Sensor

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Magnetic field concentrators (MFCs) or magnetic flux transformers (MFTs) can greatly reduce the threshold sensitivity of magnetic field sensors (MFS) or magnetic flux sensors. MFCs or MFTs based on superconducting materials are often used in devices for detecting ultraweak magnetic fields (≤ 10 nT) and magnetic fluxes in biological objects. They are included in sensors, in which various structures serve as magnetic sensitive elements (MSEs), such as Josephson contacts, Hall sensors, sensors, based on spintronic effects, etc. We studied the distribution of the magnetic field B perpendicular to the MSE surface, as well as its average value $<B>$, when all MFC, MFS and MSE elements have film structures and the same thickness.

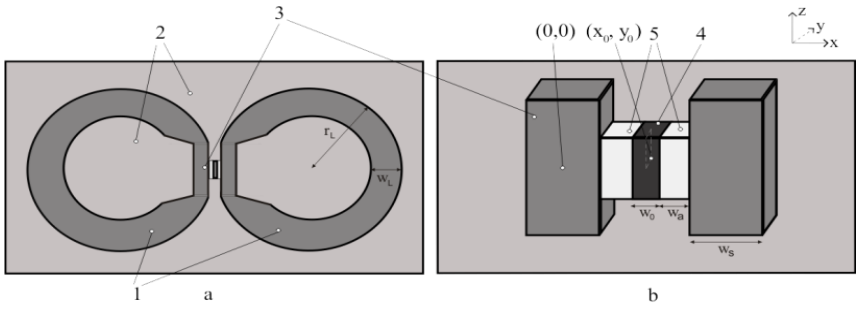

Fig. 1. Sketch of planar film superconducting magnetic field concentrator

A sketch of the proposed planar design is shown in Fig. 1, the following parameters are indicated on it: 1 – receiving rings; 2 – substrate; 3 – active strip (AS) of the concentrator with width w_s; 4 – MSE, based on film from Josephson medium with width w_0; 5 – width w_a of the gap between AS and MSE boundaries; (0,0) – origin of the coordinate system report in AS; (x_0, y_0) – coordinates of an arbitrary point MSE, where the magnetic field is calculated; w_p – cutting width. All elements deposited on the substrate have the same thickness 2*h*. The following numerical values were used in the calculations: w_s = 10 – 30 μm; w_0 = 0.2 – 50 μm; w_p = w_a = 0.02 μm; h = 0.01 μm. It has been established that for the same values of the total current in AS, the magnetic field *B*, generated in the MSE, is inhomogeneous and its degree of inhomogeneity $N_g = (B_{max} - B_{min})/\langle B \rangle$ strongly depends on the penetration depth $\lambda_\perp$ of the perpendicular magnetic field in the superconducting film. The cases of $\lambda_\perp$ change in the range of 0.25 – 4.0 μm are considered. It was found that at $\lambda_\perp \leq 0.25$ μm, high values of $\langle B \rangle$ and N_g are achieved several times relative to the case at $\lambda_\perp \geq 1.00$ μm. The calculations took into account the cuts made on the AS surface. It was found that with an increase in the number n of cuts and depending on their location, the parameter N_g decreases significantly. For example, one cut 20 nm wide and located near the far AS boundary, the N_g value decreases from 120 % to < 60 % at $\lambda_\perp = 0.25$ μm. In the case of n = 5, the parameter N_g drops even more < 20 %. Thus, increasing the number of cuts having nanoscale widths makes it possible to increase the efficiency of existing sensors such as SQUIDs and spintronic structures, in the form of increasing their resolution and reducing the size of their receiving antenna. Therefore, the sensors can detect smaller magnetic objects, including magnetic nanoparticles in the biological environment.

Acknowledgements. This work is supported by the Ministry of Science and Higher Education of the Russian Federation (project No. 075-03-2020-216 of December 27, 2019). Research at the I. M. Sechenov University in terms of computer calculation of the magnetic field concentrator was funded by the Ministry of Science and Higher Education of the Russian Federation under grant agreement No. 075-15-2021-596.

Electrically Conductive and Mechanical Properties of Flexible Films Based on Composite Nanomaterial

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Composite nanomaterials have unique properties that cannot be realized in traditional materials. Therefore, they are being actively studied to create their various applications, for example: strain

sensors, electrodes, elastomers, electronic skin, etc. [1, 2]. We studied the specific electrical conductivity σ and the mechanical properties of films and bulk samples, based on a biocompatible material in the composition: matrix – carboxymethyl cellulose (CMC), filler – multi-walled carbon nanotubes (MWNTs). The aqueous suspensions were prepared in the composition: ~ 2 wt.% CMC and 0.8 wt. % MWNT. By airbrushing, aqueous suspensions were deposited on polyethylene (PET) substrates, office paper (OP), and silicon (Si) wafers, coated with SiO_2. Massive samples were obtained after vacuum evaporation of the liquid from the suspension at room temperature (t = 22 °C). When measuring the electrical conductivity (t = 22°C, liquid volume 10 ml) of the suspension, the following data were obtained: 2 μS for distilled water; 200 μS for suspension 2 wt.% CMC/98 wt.%; 900 μS suspension 2 wt.% CMC/0.8 wt. MWCNT/97.2 wt.%. The values of σ for massive and film dry samples at t = 22 °C, taking into account their sizes, were as follows: $<10^{-6}$ S/m for massive sample CMC; 2.8 kS/m for bulk sample 2 wt.% CMC/0.8 wt.% MWCNT; 13 – 8 kS/m for film 2 wt.% CMC/0.8 wt. % MWCNTs in the thickness range of 0.2 – 23 μm. It was found that samples, containing MWCNTs have significantly higher elastic modulus and hardness than samples from CMC. In particular, the Vickers hardness H and the elastic modulus E had the following values, respectively: 0.13 GPa and 1.76 GPa for 2 wt.% CMC; 0.25 GPa and 5.87 GPa for 2 wt.% CMC/0.8 wt.% MWCNTs. The films were tested for bending. For films with a thickness of ≤ 1 μm, bending in the range of angles of ± 30° did not lead to significant changes in the value of σ at a set of bending cycles of 10^5, and for films with a thickness of > 5 μm, there was an increase by 10 – 15 %. In all cases of bending, the films were not destroyed and did not exfoliate from the substrates. Comparisons were made between the calculated and experimental results of the electrical conductivity of the studied composite nanomaterial. Under certain conditions, the electronic conductivity, mechanical parameters, and other properties of a composite nanomaterial (2 wt.% CMC/0.8 wt.% MWCNT) are easily modulated, in particular, by changing the concentration of the composition, exposure to laser radiation, or selecting a nanotechnological route map. Films are a promising functional metal-free material for the creation of various medical devices or flexible elements of microelectronics. Note that under a certain regime, this material dissolves in water and products based on it are disposed of.

Acknowledgements. The work was supported by the Ministry of Science and Higher Education of the Russian Federation (Project No. 075-03-2020-216 dated December 27, 2019). Research at Sechenov University in terms of calculating the electrical conductivity of a composite nanomaterial was carried out with the financial support of the Ministry of Science and Higher Education of the Russian Federation under grant agreement No. 075-15-2021-596.

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The Optical Properties of Co_3O_4 – ZnO Thin Films

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Zinc oxide is a multifunctional compound with a wide band gap and *n*-type conductivity. It is known that the introduction of various additives has a significant impact on physical and chemical properties of materials based on ZnO. One of the promising additives is cobalt oxide, which makes possible to obtain films with high transparency and electrical conductivity. The main aim of this study was to investigate the optical properties of Co_3O_4 – ZnO thin films. Materials were produced by the solid-phase pyrolysis, which was described earlier [1]. Zinc acetate dihydrate ($Zn(CH_3COO)_2 \bullet 2H_2O$) and cobalt acetate tetrahydrate ($Co(CH_3COO)_2 \bullet 4H_2O$) were used as precursors. During the first stage of synthesis, an intermediate product was obtained, which is a mixture of organic zinc and cobalt salts. During the second stage, the solution of the intermediate product in the non-polar solvent was applied to pre-prepared glass substrates three times. Then, the obtained substrates were calcined at 600 °C for 2 hours. As a result, three-layer thin films of Co_3O_4 – ZnO were obtained, with a molar ratio of Co : ZnO = 5 : 95 and 10 : 90. The optical properties of film materials were studied by optical absorption spectra on the UV-1100 ECOVIEW spectrophotometer (China) in the wavelength range of 300 – 800 nm. It was shown, that obtained Co_3O_4 – ZnO thin films have high transparency (more than 80 %) in the wavelength range of 300 – 470 nm (see, Fig. 1). After 470 nm, the absorption coefficient of the material Co : ZnO = 5 : 95 tends to zero. The absorption coefficient of Co : ZnO = 10 : 90 has a lower value in comparison to Co : ZnO = 5 : 95.

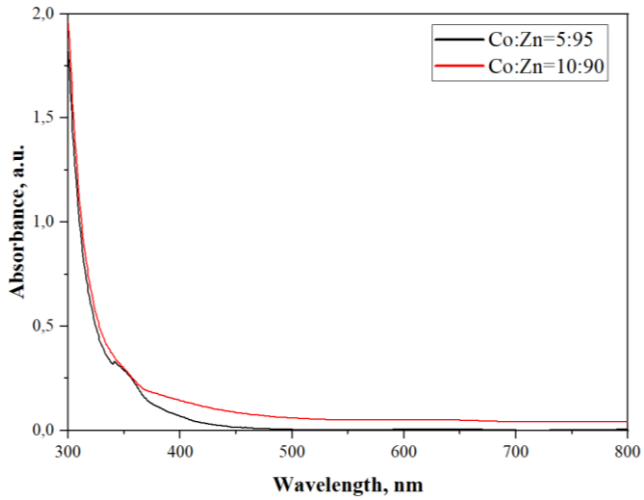

Fig.1. Absorption spectra of Co_3O_4 – ZnO films with the molar ratio Co : ZnO = 5 : 95 and 10 : 90

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Influence of the Environment on the Vibration Frequencies of a Cylindrical Shell

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Bending vibrations of a single-layer carbon nanotube are determined based on the theory of elastic vibrations of a long cylindrical shell. The shell surfaces are in contact with media of different density and pressure. The medium can be compressible during surface deformation and incompressible. The dependence of natural frequencies on the ratios of the densities of the media and the shell material, as well as the wall thickness and radius, are studied. In this study, we consider the spectrum of natural frequencies of radial bending vibrations of a long, closed shell with the parameters of a single-layer carbon nanotube and the influence of media inside and outside it on them [1, 2]. In this case, we will use the motion equations of ideal incompressible and compressible fluids with different densities and pressures of the media inside and outside the tube. It is important to elucidate the influence of media according to these models in the case of a tube of micro- and nanosizes, densities and pressures of the media, the limits of applicability of the model of continuous interaction between the walls of the tube and the liquid, and the possibility of their cavitation interaction. The incompressible fluid model is used only to determine the dynamic pressures in the medium due to the movement of the nanotube. This takes into account that static pressures and densities are related by an isothermal law. The small dependence of the vibration frequencies of the tube on the compressibility of the media is explained by their flow from the region of one half-wave to another. For each cycle of oscillations near the wall surfaces within the half-wave, there is an inflow and outflow of media, and within the framework of linear oscillations, the corresponding volumes are equal one to each other. In view of the foregoing, the model of an incompressible fluid is quite acceptable in the analysis of oscillations of the considered medium. It is important to estimate the conditions for the occurrence of cavitation interaction between a nanotube and a liquid, since this leads to a strong change in the oscillation frequencies of the system, compared to the continuous interaction. Apparently, this complex phenomenon has not yet been considered. It needs experimental study. A more accurate description of it, is possible by the method of molecular physics and numerical simulation. Here we give some estimates of this phenomenon in the case of contact between a vibrating single-layered nanotube in a liquid.

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Outsourcing Practices and Mass Customization Capability: The Moderating Role of Prevailing Business Environment

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The outsourcing practices (OPs) are widely acknowledged as a crucial strategy to achieve long-term competitive advantage. The present study aims to empirically investigate the effects of OPs on mass customization capability (MCC) of manufacturing organizations. Moreover, the moderating role of prevailing business environment (BE) on the above relationship has been examined. These hypotheses are tested through partial least squares based structural equation modelling techniques using the data obtained from a survey of 118 manufacturers from India. The results demonstrate that OPs directly and positively affect MCC, with BE serving as a significant moderator. Thus, the study concludes that in today's volatile and competitive business environment, mass customizers must use outsourcing approach to enhance their responsive, reconfiguration, and relational capabilities.

The Impact of Time-Based Manufacturing and Product Design and Development Practices on Mass Customization Capability

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The present study investigates the impact of time-based manufacturing (TBM) and product design and development (PDD) practises on the mass customization capability (MCC) of firms working in manufacturing sector, as well as whether prevailing business environment (BE) has an effect on these relationships. To accomplish this, data was gathered via a questionnaire-based survey of Indian manufacturing firms, and structural equation modelling based on partial least squares technique was employed to examine the aforementioned relationships. The findings show that both TBM and PDD positively affects MCC of manufacturing firms and the intensity of these relationships is strengthened by the prevailing business environment. As the prevailing BE is getting fiercer day-by-day; the impact of above practices on MCC becomes more significant. The findings implicate that to survive and excel in today's dynamic environment, manufacturers must focus on the enhancement of their MCCs by allocating more efforts to implement aforementioned strategies and practices.

Productivity Analysis Using the Marvin E. Mundel Method (Case Study at UD. Sabar Jaya)

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The development of the fruit chips industry requires business actors continue to increase the competitiveness of the products they produce. Competition among them is measured by the level of productivity of the companies. UD. Sabar Jaya is one of the quickly growing fruit chip industries in Malang Regency. During this time, UD. Sabar Jaya has never done productivity measurements. The company only sees profits from the sale of production as a measure of the company's productivity. Therefore, UD. Sabar Jaya needs to measure productivity. The Marvin E. Mundel method was used as a method of measuring productivity by focusing on production costs as input (depreciation costs for machinery, materials, labor, machine maintenance, energy expenses and utilities) and sale results as output. From the productivity measurement, the highest partial productivity index results were achieved by the company in May 2013, namely 127.43% for machine cost depreciation, 329.79% for materials, 127.43% for labor and 142.23% for energy expenses and utilities; in November 2012, it was 171.54% for machine maintenance. Whereas the lowest partial productivity index, achieved by the company, occurred in June 2013. It was 37.54% for machine depreciation, 37.54% for labor, 41.89% for energy and utilities; in May 2012, it was 59.76 % for machine maintenance and in December it was 33.61% for materials. The highest total productivity index (216.12%) was achieved in May 2013 and the lowest value (43.71%) was in December 2013. Evaluation and productivity improvement at UD. Sabar Jaya for the coming period was done with a causal diagram. Based on the measurement results and productivity evaluation results at UD. Sabar Jaya, increasing productivity can be done by improving each input, including increasing service and maintenance of production machines by increasing supervision of employees, control over materials sent by suppliers, and so on.

Productivity Measurement and Analysis at PT. Three Manunggal Synthetic Industries Using the Objective Matrix (OMAX) Method

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Productivity measurement was conducted at PT. Three Manunggal Synthetic Industries. PT. Tiga Manunggal Synthetic Industries is a textile industry, which produces polyester fabrics that are exported to the Middle East, Japan, Africa and Vietnam. Because many other industries engaged in the same field, it is required from companies to continuously improve every aspect of the company activity, both outside and inside. One of improvement efforts that can be done is to increase the productivity of the company. Measurement and analysis of important productivity are conducted to determine the level of efficiency and effectiveness of resource used. With high productivity, the company is expected to continue to be competitive. Therefore, it is necessary to measure productivity. By measuring the productivity, the company can see the achievements that have been attained as the basis for planning the company's future. Productivity measurement is done by using Objective Matrix (OMAX) method. In this company a productivity has been good,

but there are still some periods, when productivity has decreased from the previous period. The increase in productivity occurred during December 2014, May 2015, June 2015, August 2015 and October 2015; moderate decrease occurred during January 2015, February 2015, March 2015, April 2015, July 2015 and September 2015. The highest increase of productivity (0.501) was in December 2014, and the lowest productivity (0.496) took place in September 2015. The criteria that require of improving are the productivity of workers, the working hours of machine, and the use of electrical energy.

Synthesis and Characterization of $ZnFe_2O_4$ Based on Iron Sand as a Magnetic Particle Material

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Technology is currently progressing very rapidly. One of them is sensor technology. Ones of the many sensors developed are the magnetic sensors. The magnetic sensors are sensors that measure physical quantities based on changes in the magnetic field [1]. Changes in the magnetic field are strongly influenced by the magnetic material that makes up the sensor. Soft magnetic materials are important part of spinel ferrite with high magnetic permeability, high magnetization saturation and high resistivity. Spinel structures MFe_2O_4, where *M* denotes metal elements with a valency of 2+, such as Mn^{2+}, Zn^{2+}, Ni^{2+}, Mg^{2+}, Co^{2+}, Fe^{2+}, and Cu^{2+}, have been studied in [2 – 6]. $ZnFe_2O_4$ is a material with normal spinel structure which has characteristics of saturation magnetization and low coercivity. The aim of this research is to find out how to synthesize and characterize $ZnFe_2O_4$ based on iron sand. The first strep is to synthesize iron sand into Fe_2O_4 by coprecipitation method. The second step is the synthesis of $ZnFe_2O_4$ with the coprecipitation method as well. Characterization analysis of $ZnFe_2O_4$ using X-Ray Difraction (XRD) and Transmission Electron Microscopy (TEM) has been performed. The XRD results define the crystal structure of the synthesized $ZnFe_2O_4$, while the TEM results show the results of the particle size distribution and structure composition.

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Physical Properties and Structure of xBiFeO$_3$ – (1 – x)PbZr$_{0.9}$Ti$_{0.1}$O$_3$ Composites

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Multiferroics belong to the class of "smart materials" with unique properties, exhibiting coupled ferroelectric, ferromagnetic, and ferroelastic ordering. The properties and structures of multiferroic materials determine their applications as converters, information storage devices, spintronics, sensors, and resistive switching elements [1, 2]. In this study, composites xBiFeO$_3$ – (1 – x)PbZr$_{0.9}$Ti$_{0.1}$O$_3$ (x = 0.2, 0.4, 0.6, 0.8) were synthesized using the solid-phase reaction method, and their structure and physical properties were investigated. The composites were found to possess a rhombohedral perovskite structure in both the ferrite and ferroelectric phases. The dielectric measurements revealed a ferro-paraelectric phase transition of PbZr$_{0.9}$Ti$_{0.1}$O$_3$ at around 290 ºC, and T_C decreased with increasing PbZr$_{0.9}$Ti$_{0.1}$O$_3$ content. Complex impedance measurements showed a single arc for BiFeO$_3$ samples in the temperature range of 110 – 170 ºC, while composites with higher proportion of PbZr$_{0.9}$Ti$_{0.1}$O$_3$ exhibited a dual arc characteristic of heterophase compositions in the temperature range of 160 – 230 ºC, indicating both the grain and grain boundary effects of the conduction mechanism. Doping with PZT resulted in a non-monotonic decrease in the bandgap E_g and non-monotonic behavior of the stretching vibration components in the FTIR spectra. The analysis of the magnetic hysteresis loops of xBFO – (1 – x)PZT powder showed the presence of weak ferromagnetism, which could be associated with the structural distortion, caused by the partial substitution of $(Ti/Zr)^{4+}$ by Fe^{3+} (see Fig. 1). These findings provide valuable insights into the structure and properties of xBiFeO$_3$ – (1 – x)PbZr$_{0.9}$Ti$_{0.1}$O$_3$ composites and could contribute to the development of new multifunctional materials with potential applications in various fields.

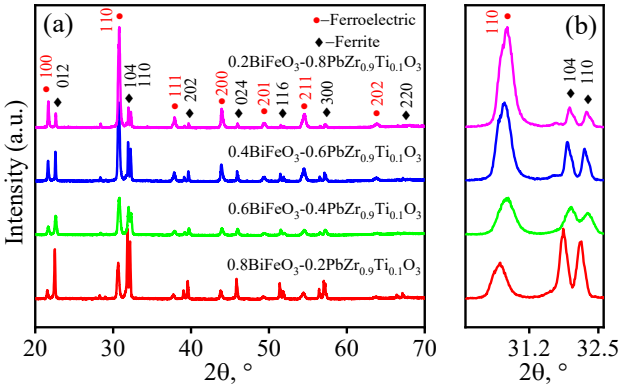

Fig. 1. XRD patterns of the powder samples: (a) xBiFeO$_3$ – (1 – x)PbZr$_{0.9}$Ti$_{0.1}$O$_3$ (x = 0.2, 0.4, 0.6, 0.8); (b) the selected angular patterns.

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Analysis of Balanced Furniture Product Requirements with Fuzzy Goal Programming Model Development

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Furniture SMEs production activities need a balance between the supply of wood raw materials and the need for furniture products. The amount of wood raw materials in the forest is limited, so furniture production activities must be controlled properly, so that the supply chain balance of furniture products starting from wood raw materials, production activities, and products received by consumers is maintained properly. Furniture SMEs must carry out production activities in accordance with realistic demands. There is too much and too little furniture production, so it has an impact on other aspects that are interrelated, so a balance between supply and demand is needed. The Fuzzy Goal Programming (FGP) method is appropriate for making decisions to determine how much raw material should be provided by Indonesian forest companies using the FGP model. The FGP method can maximize or minimize the resources owned by furniture SMEs by using several objective functions and constraint functions. Furniture SMEs products include cupboards, sideboards and beds. The FGP method is able to provide precise and clear information on the optimal amount of production so that no losses are received by furniture SMEs. Based on the data analysis, the results show a fuzzy value of 0.98, so the profit opportunities for furniture SMEs are very high, and provide many benefits for the development of furniture SMEs.

Engineering Drawing Reading Training for Sales and Production Teams at PT. X

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Technical drawing reading training is not widely offered on the market, so partners experience it constraints in the availability of resource persons who can provide material. This training is a community service activity that aims to provide knowledge and understanding in reading technical drawings. Collaborative partners in community service activities are PT. X. The flow of steps for community service activities is carried out through identifying problems that occur with partners, determining priority scales that need corrective action, solving problems by providing training, feedback in the form of evaluating the review of the results of training activities. Stages of training activities carried out include presentation of training materials, discussions, questions and answers and evaluation of training. The implementation of training activities is carried out online using the zoom meeting video conference application. The training materials for reading technical drawings

cover 4 topics, which include standardization, describing technical drawings, welding symbols and tolerances. Results of technical drawing reading training activities in community service for the sales and production team of PT. X as a training participant has gained knowledge and understanding in reading technical drawings. Based on the results of the evaluation of the training activities that have been carried out, it is stated that the training can broaden the knowledge of technical drawings so that partners can improve capabilities and skills in carrying out the duties and responsibilities of work in the company.

Critical Nature of the Giant Values of the Converse Piezoelectric Moduli in $Pb(Mg_{1/3}Nb_{2/3})O_3 – PbTiO_3$ Ceramics

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Single crystals of solid solutions based on relaxor ferroelectrics, characterized by huge values of piezoelectric, dielectric, electrostrictive, pyroelectric, and other responses in a wide temperature range, are of great interest for applications. The high values of different responses in relaxors are due to the presence of polar nanoregions in them, which are very sensitive even to a small external effect. It was previously established that in single crystals of solid solutions of the classical relaxor $Pb(Mg_{1/3}Nb_{2/3})O_3$ (PMN) with the ferroelectric $PbTiO_3$ (PT), the giant piezoelectric response (corresponding to the direct piezoelectric effect) has a critical nature [1, 2]. There is a line of critical points in the *x*, *E*, *T*-phase diagram of the PMN-PT system and the compositions from the morphotropic region (MO) approach this line [1]. Later the possibility of a significant increase of piezoelectric moduli for the direct piezoelectric effect (hereinafter, for brevity, direct piezoelectric moduli) of PMN-PT single crystals, the composition of which is far from MO, by applying the electric field was established [2]. Such effect "shifts" these compositions towards the critical point and the field dependences of the maximum values of the piezoelectric moduli are critical. In contrast to crystals, in PMN-PT ceramics, it has not yet been possible to achieve giant values of piezoelectric moduli for the direct piezoelectric effect, even in highly textured samples [3]. At the same time, the values of the piezoelectric modulus *d* in the case of the converse piezoelectric effect (hereinafter, for brevity, the converse piezoelectric modulus) in PMN-PT ceramic samples and soft ferroelectric multicomponent piezoelectric ceramics in a certain field range are comparable to those for the single crystals [4]. This is due to unlike conventional ferroelectrics, for ferroelectrics with a diffuse phase transition and relaxors, the contribution of small domains and polar nanoregions, as well as electrostriction, to the total value of the piezoelectric modulus is large, therefore, the $d(E)$ dependence is nonlinear and the converse piezoelectric modulus is usually far larger than the direct one, which is promising for practical use. Revealing the nature of the field dependence of the converse piezoelectric moduli near the critical point in the $E – T$ phase diagram, will make it possible to determine ways to increase dramatically the piezoresponse of PMN-PT ceramics. This, in turn, will significantly reduce the size of many piezoelectronic devices and expand the scope and scale of their application.

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Conductive Filament Distribution in Memristor Titanium Oxide Nanodots

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A memristor is an electronic component capable of retaining memory of past states and adjusting its resistance based on the current and applied voltage. It has found applications in non-volatile memory devices, artificial neural networks, and other fields. Among the materials exhibiting memristor properties, titanium oxide (TiO_2) is well-known [1]. In TiO_2, the memristor effect arises from defects in the crystal lattice, which create traps for electrons and titanium ions. These defects enable changes in conductance levels in the memristor through the switching effect, induced by an electric field. Simulation methods are effective tools for studying the conductive channel formation processes in nanoscale TiO_2 memristor structures. Such simulations allow for the analysis and prediction of memristor properties based on various physical models, such as the representation of generation/recombination processes, diffusion, charge transfer, and other relevant phenomena. To model conductive filaments in oxide memristors, a combination of Poisson's equation and transport equations can be employed. In this study, the COMSOL Multiphysics software is used to model defect-free titanium oxide dotted structures and consider processes like oxygen vacancy generation/recombination and migration under an electric field [2]. The experimental device comprises a bottom titanium electrode and an oxide nanostructure produced through the LAO-technology, with a microscope probe serving as the top electrode. Simulation results reveal the existence of points on the section of oxide, within the probe-oxide contact area, exhibiting maximum electric field strength. Local deformations of the probe or the oxide amplify the electric field concentration in these points. The regions with the highest electric field strength in the oxide nanostructure serve as sites for filament formation, where vacancies are generated and subsequently propagate due to the applied electric field. These simulation findings facilitate the optimization of nanoscale memristor structures for specific applications, as they provide insights into the conductive filament formation processes in oxide nanostructures.

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Optical Band Gap of $Sr_{0.61}Ba_{0.39}Nb_2O_6$/MgO(100) and $SrTiO_3/Al_2O_3$ (0001) Films Depending on Their Thickness

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Nanoscale films of solid solutions of ferroelectrics $Sr_xBa_{1-x}Nb_2O_6$ (SBN-*x*) and $SrTiO_3$ (STO) are widely known materials promising for their use in modern micro- and optoelectronics. This report presents the results of our studies of the dependence of the band gap of nanosized $Sr_{0.61}Ba_{0.39}Nb_2O_6$/MgO (100) and $SrTiO_3/Al_2O_3$ (0001) films on their thickness. The films were obtained by HF cathode sputtering of stoichiometric ceramic targets in an oxygen atmosphere onto the corresponding single-crystal substrates. The optical transmission spectra were studied in the region of fundamental absorption. The film thickness was determined both from the transmission spectra and from the results of ellipsometry measurements. In addition, ellipsometry made it possible to establish the absence of film-substrate boundary layers and to find the thicknesses of surface damaged layers ($d_{dist} = 5 - 7$ nm). An analysis of the fundamental absorption edge showed that the interband transitions in the SBN-61, SBN-50, and STO films, regardless of their thickness and substrate material, are generally direct, but the experimentally observed band gap $E_g^{(ef)}$ depends on the film thickness.

Table 1

Spraying time, min	Film thickness *d*, nm	Observed bandgap $E_g^{(ef)}$, eV	Contribution of the damaged layer, %	Film bandgap E_g, eV
$Sr_{0.61}Ba_{0.39}Nb_2O_6$ on the substrate MgO (001)				
5	34	4.61	27	4.07
10	45	4.48	16	3.98
60	418	4.12	7	4.06
115	630	4.06	1	4.01
$SrTiO_3$ on the substrate Al_2O_3 (0001)				
5	17	2.55	41	3.63
10	55	3.3	13	3.72
20	130	3.5	5,6	3.71
45	205	3.6	3.4	3.72

As the thickness increases, the value $E_g^{(ef)}$ approaches the value $E_g^{(0)}$ of the corresponding bulk crystal ($E_g^{(0)}$ = 4.06 eV for $Sr_{0.61}Ba_{0.39}Nb_2O_6$ and $E_g^{(0)}$ = 3.75 eV for $SrTiO_3$). The results of measurements and calculations of the bandgap of the SBN-61 and STO films are present in Table 1. It can be seen from the tabular data that the value $E_g^{(ef)}$ observed in STO films increases with increasing thickness. This is most likely due to a change in the band structure in nanoparticles of the damaged layer, which, as a consequence, leads to indirect transitions, the proportion of which is proportional to the contribution of the damaged layer to the total film thickness. Perhaps this is due to the formation of an energy gap in the conduction band of the nanoparticles of the damaged layer SBN-61.

Embedding Epitaxial VO_2 Film to Switchable Two-band Filter on the Surface Acoustic Waves

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The paper proposes a tunable bandpass filter, the operating frequency of which in the range of 600 – 800 MHz is regulated by voltage [1]. It is performed on a piezoelectric substrate made of lithium niobate and contains four parallel acoustic channels, formed by two input interdigital transducers (IDTs), two multi-band directional couplers and two output IDTs with the ability to switch each pair of acoustic channels. The independent vanadium dioxide film switch provides attenuation between channels of at least 70 dB [2 – 6]. The use of acoustic channel switches, made of vanadium dioxide film, reduces the control voltage to 0.1 V. The width of the vanadium dioxide film is no more than two periods of input IDT, which eliminates an increase in the attenuation of surface acoustic waves with an increase in the operating frequencies of the filter. The vanadium dioxide film was produced by pulsed laser deposition for 4000 pulses at T = 560 °C and $P(O_2) = 2\times10^2$ mbar. The thickness of the vanadium dioxide film was 200 nm.

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Energy and Waste Integrated Food Security-Based Climate Village Program in Kebonsari Village Towards Sustainable Proklim Village Surabaya

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Kebonsari Village, which consists of 3 RWs, is one of the areas in Surabaya that pays attention to the environment and is oriented towards becoming a climate village. This is shown by the

environmental activities that have been carried out by residents related to the arrangement of slum areas and waste management. In the area, there are many unproductive vacant lots that are currently being utilized by residents for urban farming and cultivation. Based on the results of discussions between ormawa, universities, Kebonsari village, residents of RW 1, 2, 3 and Surabaya city Government through DLH (Environmental Agency), the focus of the climate village achieved in 2022 is related to urban village food security, supported by waste and waste management and utilization of new renewable energy. There are 4 main problems raised, namely: (i) how to maximize land for superior food commodities and greening, (ii) how to process waste that can be used for urban farming plant fertilizer and fish farming feed, (iii) how to treat wastewater in order to minimize the use of well water/PDAM for watering urban farming and (iv) how to minimize the use of electrical energy for watering urban farming and aeration of aquaculture ponds. The solution provided is divided into 4 problems solving activities and 2 supporting activities. 4 problems solving activities include: (i) producing land for urban farming of kale plants as the queen of vegetables that have high nutrition and are needed during the current pandemic, (ii) processing organic waste as food for worm and maggot cultivation which can produce worms and maggots to save fish feed and produce kascing (used worms) and kasgot (used maggots) to save the use of plant fertilizers, (iii) treating waste water in sewers using a simple WWTP to save the use of groundwater/wells/PDAM used for watering urban farming plants, (iv) using solar panels as new renewable energy integrated with pumps and aerators to save electricity use when watering plants or aerating fish farming ponds.

Analysis of Work Achievement Weight and Productivity Index UD. Samudra Jaya Abadi with the OMAX Approach

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OMAX approach estimates a productivity comparing output and input data by combining productivity criteria into an integrated form and related one to other. In addition, it is able to evaluate several productivity criteria with weights to get an overall productivity index. In the case that occurred at UD. Samudra Jaya Abadi, there are 15 periods with 7 criteria using, the OMAX approach. From the results of the calculations that have been carried out, it produces a performance ratio on each criterion, average and standard deviation on each criterion, upper control limit (UCL) and lower control limit (LCL), weight value on each criterion, score for each period, work achievement, and productivity index. Then the conclusion obtained is that there is a decrease in performance but then increases again, namely February 2022 – March 2022, April 2022 – May 2022, June 2022 – July 2022, September 2022 – October 2022, November 2022 – December 2022, January 2023 – February 2023. The Productivity Index for these months will then be calculated. A productivity index in March 2022 was 0.18, a productivity index in May 2022 was 1.04, a productivity index in July 2022 was 0.06, a productivity index in October 2022 was 0.28, a productivity index in December 2022 was 0.28, a productivity index in February 2023 was 0.13.

Finite Element Modeling of Cornea Indentation by the Rockwell Method

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To develop eye prostheses and prevent diseases, studying the mechanical characteristics of the cornea is essential. However, direct measurement of the cornea's mechanical properties is not possible during ophthalmological study. Data can only be obtained experimentally on an enucleated eyeball, which changes the true values of the characteristics. Cornea's heterogeneity and different tissue thickness make an accurate analysis of tissue state impossible. As an alternative, finite element method analytical and numerical models of the cornea are being developed as an experimental substitute. The study proposed in this report aims to examine the stress-strain state of the cornea while considering intraocular pressure in the contact area when using a spherical indenter, using the Rockwell method [1 – 3]. To achieve this, mathematical modeling employs an axisymmetric model, depicting the cornea as a momentless elastic surface. The study evaluates how various geometric and physical parameters such as the radius of curvature of the cornea, shell thickness, and its elastic modulus influence the deformation parameters. The behavior of load measurement is modeled by contact problems using the ANSYS software system. Before loading, an incompressible pressurized fluid fills the shell. The cornea's heterogeneity is not considered at the initial stage of the study, and the materials are set as isotropic. First, internal pressure is applied in the first loading step, followed by the application of force in the subsequent steps. Qualitative analysis of the cornea at this stage considers it as a monolayer, which simplifies the analysis process. However, in the future, it is expected to analyze the loading on the cornea using a multilayer model, which is complex due to the thickness differences of the layers. Therefore, the model cannot be viewed as a thin-walled object. One approach involves considering the cornea initially as a poroelastic, two-layer, contact model that includes a Bowman layer and a stroma layer.

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Study of Plasma Etching Modes in Combined Plasma on Silicon Surface for the Formation of Optoelectronic Structures

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Self-organizing A_3B_5 quantum dot systems are one of the important issues in the field of optoelectronics [1]. Studies of processes, affecting the self-organization of quantum dots on the surface and methods of influencing the substrate on the controlled formation of structures with specified properties, are relevant [2]. In experimental studies, *n*-Si (100) plates with a resistivity of 0.001 – 0.005 Ω/cm were used. Fluoride plasma, formed during the decomposition of sulfur hexafluoride (SF_6), was used to interact with the structure. Plasma etching was carried out in a combined discharge with the following parameters: pressure P = 10 Pa, process temperature T = 25 °C, treatment time t = 30 s, power of capacity of capacitive plasma W_{CCP} = 35 W, power of inductively coupled plasma source W_{ICP} = 300 – 600 W, bias voltage U_{bias} = 15 V, fluorine gas flow N_{SF6} = 10 cm^3/min, argon flow N_{Ar} = 60 cm^3/min. The morphology of the obtained structures was studied by atomic force microscopy (AFM).

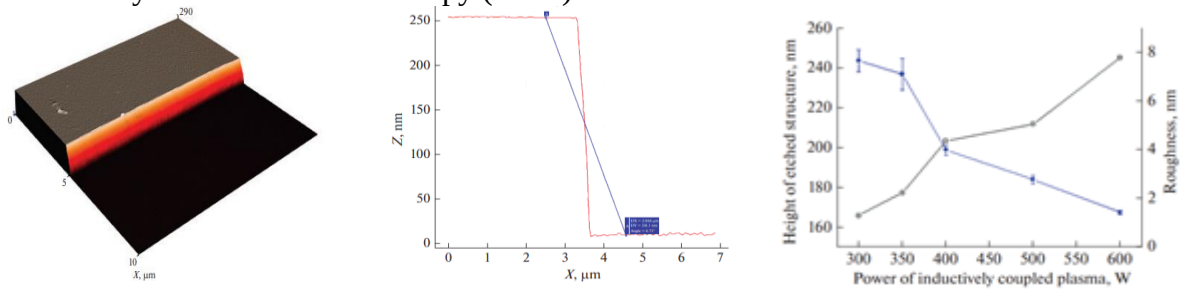

Fig. 1. Images of the etched structure, the profile of the structure and the resulting dependencies

The analysis of the obtained dependences showed that the dependence of the height of the structure on the power of the ICP source has a linear character, which is associated with an increase in the degree of ionization of the fluorinated gas and the ion energy in the plasma with an increase in the power of the ICP source. By increasing power, the roughness decreases, due to plasma chemical polishing. Thus, structures with a height of 245.2 nm with a roughness of 1.56 ± 0.1 nm were obtained.

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Development of Algorithm for Moving the Car Forward to Obstacle

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This article presents the implementation of a remotely controlled robot car. The robot is a car model chassis, and Raspberry Pi 4 and Robot HAT are used to control the robot components and execute code. Motion control algorithms are implemented in Python, allowing the robot to maneuvering and overcome obstacles, using an ultrasonic sensor. For remote control over a single network, the Flask server is used. Robotics is a dynamic field that combines hardware and software to create intelligent systems capable of performing complex tasks. This study is devoted to the approach to remote control of automated vehicles using web technologies. The main goal of this study is to apply algorithms to control the movement of a robotic remotely controlled vehicle that can navigate in the environment and overcome obstacles, using ultrasonic sensors, and control it through a web interface. This study demonstrates the possibility of using web technologies for remote control of the movement of robots. Using Python, Raspberry Pi and Flask has proven to be an effective method for building remote controlled robot car. In the future, more sophisticated navigation and control algorithms could be implemented with expansion of the capabilities of the web interface, or connection of additional sensors to get more advanced features.

Sharpening and Creation of Probes for the Atomic Force Microscope NanoEducator

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The method belongs to the field of atomic force microscopy, and specifically to a method for improving the output image. Atomic force microscopy (AFM) is a scanning probe microscopy technique that makes it possible to study the surfaces of materials with atomic resolution. morphology definitions and local properties of a solid surface with high spatial resolution. Atomic force microscopy studies the morphology, structure, properties and surface defects of metals, semiconductors, dielectrics and other materials, as well as molecular structures, membranes, cells, proteins and other biological objects. In this abstract, the following masses were applied: 0.2, 0.15 and 0.1 g at voltages of 1.5, 3 and 4.5 V. Each of these voltages corresponds to three probes with the same mass. In our research, an attempt was made to develop a new method for sharpening tungsten probes for an atomic force microscope. The basis of this research is the application of electrochemical etching of tungsten probes. The main motivation for the development of this method is the need to create an accessible, quick and cost-effective technology that can significantly improve the efficiency of laboratory work. In addition, a comparison is made with already existing etching methods.
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Solving the Problem of Shipping Goods by Transportation Method

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A wood pallet company has 4 factory locations, namely in Jakarta, Bekasi, Jogjakarta, and Semarang, with a capacity of 55,000, 65,000, 60,000, and 80,000 units each. The production of the five factories will be distributed to 6 marketing destinations, namely regions 1, 2, 3, 4, 5 and 6. The demand for the 6 regions is 60,000, 35,000, 45,000 and 50,000 units, respectively; 20,000 and 50,000 pieces. Let us define the decision variable X_{ij} as the number of units of product or goods, sent from *i*-th source to *j*-th destination. The company's goal is to minimize the costs that must be incurred by the company to distribute products from the warehouse to the marketing A method of transportation is a method, used to regulate distribution from sources of the same or similar commodity or product to a destination with the aim of minimizing the incurred transportation costs. This distribution is done in such a way that requests from several destinations can be met from several points of origin, each of which may have different demands or capacities. Taha in Fitri (1996) suggested that the transportation model seeks to determine a plan for the transportation of goods from a number of sources to a number of destinations. The calculation of the global solution is found with a minimum cost. The total iteration used is 11. The variable values are known, namely: X_{11} = 5,000, X_{21} = 20,000, X_{22} = 35,000, X_{24} = 10,000, X_{34} = 40,000, X_{35} = 20,000, X_{43} = 45,000, X_{16} = 50,000. From the results of these calculations, then proceed to find out the optimal solution using Lingo Software. The results, obtained using Software Lingo, are equal to Rp. 1,567,500 from Jakarta to Region 1 as many as 35,000 pieces; from Bekasi to Region 2 as many as 30,000; from Bekasi to Region 6 as many as 30,000 pieces; from Jogjakarta to Region 4 as many as 40,000 pieces; from Jogjakarta to Region 5 as many as 20,000 pieces; from Semarang to Region 1 as many as 25,000 pieces; from Semarang to Region 3 as many as 45,000; from Semarang to Region 4 as many as 10,000.

Automated Cleaning System for Environmentally Friendly Fuel

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Dimethyl ether is an alternative fuel that has recently been used as biodiesel. The main advantage of dimethyl ether is its environmental friendliness. Dimethyl ether is capable to reduce emissions of harmful substances into the atmosphere, which makes it safer for the environment [1]. Dimethyl ether is made by hydration of methanol in the presence of a silica catalyst. It is colorless and has a light, pleasant smell. Dimethyl ether is used in conventional diesel engines without additional modifications [2]. The authors considered the automation process, which ensures the delivery of fuel to the installation, the cleaning process, and the delivery of purified fuel to the place of use [3]. One of the main benefits of automating a clean fuel treatment plant is the minimization of environmental impact. Automation establishes a process of high efficiency and reduces the amount of environmental impact [4]. Another benefit of automating a clean fuel treatment plant is the

reduction in process time. Automation allows one to reduce the time of fuel use and reduce the cost of its use. In addition, automation of the installation for cleaning environmentally friendly fuel allows one to reduce the cost of installation and adjustment of the fuel cleaning system. Manual tuning requires a significant investment of time and money. Automation allows one to manage the fuel cleaning process without the need for the constant presence of the performer. Also, automation of the installation for cleaning environmentally friendly fuel can improve the quality of fuel cleaning. This is achieved by fine-tuning the plant, its configuration and control system. The innovative technologies used in the automated plant solve many of the problems, associated with the use of non-environmentally friendly fuels. They reduce the environmental impact and improve fuel quality [5]. Automating an environmentally friendly fuel treatment plant is an important step in saving the environment and improving fuel efficiency.

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Automation of Strength Calculation of Flange Connections Using Mathcad Computer Mathematics System

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Manifold is a piece of drilling equipment that is a part of oil and gas fittings, represented by an entire block of piping and valves, used as part of many units in the oil and gas industry. Despite of the fact that most of its components are formed by typical parts, manifold is unique for each separate construction due to different location of equipment elements, which makes it necessary for the designer to study its proper functioning in each certain case. High-pressure fluids are pumped during hydraulic fracturing, so it is important to study the strength characteristics of this system (including manifold). The purpose of this study is to check the strength of the manifold nodes and its operability as whole. The objectives of the study are to conduct strength calculations

of manifold attachment nodes to determine their suitability for high-pressure operation, as well as to automate the calculation of the flange connection. A 3D model of the manifold of a mobile pumping unit for hydraulic fracturing was built for the study. The program Compass-3 D was used as CAD. To test the hypothesis about reducing stagnation zones in the new manifold design, several most popular designs with certain features were considered: (i) "ChecV" ("Classic" model), used in known models of three-plunger pumps; (ii) "ChecOp" – using a one-piece design eliminates premature failures due to destruction of welds, (iii) "ChecRing" – model proposed at F.E.T. [1]. The "classical" design of the straight-through suction manifold, which was used for further research, had the best characteristics in terms of the size of the deposited proppant. The plunger pump was connected to high (low) pressure manifolds by flange connections. The requirements to reliability of such connections were rather high, therefore, all flange connections, used in the design of the pump unit, are subject to verification calculations. Stresses in the inner bore of the transition coil, caused by proppant solution pressure, have been calculated. The reliability and tightness of the manifold as whole depends largely on the strength of the stud connection in the flanges. To determine the strength characteristics, the high-pressure manifold transition spool connection to the pump by means of a flanged connection was considered. The tightening of the flanges in the connection is carried out by means of studs. In the pump NP-720 under consideration, the flow of liquid containing proppant at maximum pressure of 105 MPa passes through the transitional coil. The values of arising stresses and forces stretching the stud have been determined in Solidworks program. Tensile forces on the stud have also been taken into account. In addition, for the given node, strength calculation has been made in accordance with GOST R 52857.4-2007 "Norms and methods of strength calculation. Calculation of strength and tightness of flange joints". The standard establishes standards and methods of calculation for strength and tightness of flange joints of vessels and apparatuses made of carbon and alloy steels, nonferrous metals used in chemical, petrochemical, oil refining and related industries, operating under single and repeated loads under internal overpressure or vacuum, under the action of axial forces and bending moments. The process of selecting and calculating a flange connection for a particular installation can take a considerable amount of time. In order to be able to carry out the necessary research and optimization of flange connection parameters during the design process, the automation of flange connection strength calculations was proposed. PTC Mathcad program [2] was used for calculation automation. Some coefficients were selected by nomograms. In order to find the coefficients, presented in the standard in the form of graphical dependences, they were translated into empirical formulae. Analysis of nomograms made it possible to obtain an array of points and process by using the method of multifactor regression analysis. We built a mathematical model in the form of a function. The adequacy of the model was checked by Fisher's criterion. The condition is fulfilled, so the model is accepted as adequate. The obtained results allow us to accept the necessary coefficients in the calculation as input parameters. The automated calculation variant proposed in the work fully corresponds to the GOST methodology and allows one to calculate a large set of variants for a short time, which accelerates the design time and allows one to select the necessary variant of flange connection design and perform its verification calculation much faster.

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Design of Universal Pumping Unit

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Since field development in Russia began in the 19th century, there have been a large set of wells with hard-to-recover reserves that have not been produced due to a lack of technology. Therefore, the issue of reopening old wells and intensifying new ones is relevant today. The flagship technology for this is hydraulic fracturing. In order to perform hydraulic fracturing successfully, it is necessary to use modern and reliable equipment [1], an important part of which is a mobile high-pressure pumping unit. The aim of the study is to design the pumping unit, using the methods of mathematical modelling and strength calculation of the frame structure of the improved mobile pumping unit for various types of loads. The tasks of the research are the selection of the NP 720 plunger pump drive unit [2] with the weighting of the units on the KAMAZ 63501 chassis and the design of the subframe structure and its strength calculation. When selecting the units, a method of automatic selection of the operating mode of the plunger pump drive part was created. As the pump unit is universal, there is a need for several pump operating modes. Any maximum pressure or maximum flow is required for different tasks. It is therefore necessary to select the operating mode for each engine and automatic transmission. Knowing the torque and speed of the pump input shaft and the gear ratios of the integrated gearbox and automatic transmission, it is possible to calculate in which gear and at which engine speed the conditions for each pump mode are met. The first calculation showed that the front bogie of the KAMAZ 63501 chassis was underweight and the rear bogie was overweight (close to the maximum permissible). It was decided to make adjustments to the arrangement of the units on the bogie. The entire superstructure was moved 300 mm closer to the cab, and the position of the spare wheel was moved to the rear of the chassis. The new calculation showed that the load on the front bogie increased by 1 ton of strength and the load on the rear bogie decreased by 1.2 ton of strength. This resulted in a weight distribution of 40/60, which is a good indicator for special vehicles with high off-road capability. The next step was to determine the mounting points of the subframe to the chassis. To calculate the bolted connection between the KAMAZ 63501 chassis and the superstructure in the form of a high-pressure pump unit, it was necessary to know the weight of the mounted units and the operating conditions. From the first equation of forces, we took the weight of the whole unit, and from the chassis data we took the acceleration under braking. By varying the bolt diameter from the standard values according to GOST 7798-70, we obtained the required number of anchoring points. Then by means of finite elements method in MathCad package we reproduced the method of strength analysis of statically indeterminate beam, which consisted in body partitioning into finite elements, calculation of element characteristics, selection of interpolating functions, formation of equations for finite elements grid, solution of equation system, construction of nodes displacement diagram and construction of their epures.

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Influence of Annealing Temperature of Al-ZnO Films on Their Photoconductivity

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Research on aluminum-zinc oxide (Al-ZnO) films is relevant and of considerable interest in scientific and engineering circles for several reasons, but the main one is the wide range of applications Al-ZnO-based films can be used in various fields, including energy, optics, electronics, photonics, and sensorics. In this work, the photoconductivity parameters of Al-ZnO thin films synthesized by solid-phase pyrolysis at 550 °C and 650 °C annealing temperatures were studied. Al-ZnO nanocomposite films were deposited on polycore substrates with Al:Zn molar ratios of 5:95, 10:90. The procedure for obtaining thin films is described in [1]. During the experiments, the reaction of photocells to exposure to light, emitted by the LED of different wavelengths (470 nm and 400 nm) was measured (see Fig. 1). It was found that the greatest response was observed on all samples, when exposed to light with a wavelength of 400 nm. Table 1 shows the results of calculations of the response time $t_{0.9}$ and the time constant τ.

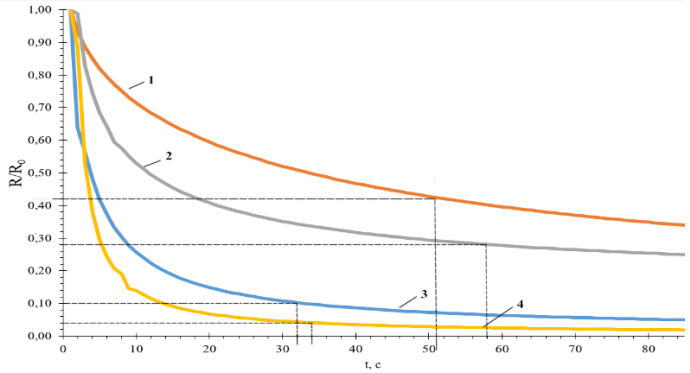

Fig. l. Time dependences of the normalized resistances of A1:Zn samples, annealed at 550 °C and molar ratios of 5:95 (curve 3), 10:90 (curve 1); and 650 °C and molar ratios of 5:95 (curve 2), 10:90 (curve 4), when exposed to light (400 nm)

Table 1

Concentration	τ, s	$t_{0.9}$, s
5Al-95ZnO at 550 °C	5	15
5Al-95ZnO at 650 °C	9	30
10Al-90ZnO at 550 °C	16	38
10Al-90ZnO at 650 °C	4	9

Based on the data in Table 1, we can say that the film 5A1-95ZnO annealed at 550°C shows higher-sensitivity than the film 10A1-90ZnO annealed at-550°C which is most-likely due to the surface-properties of the material. And for samples annealed at-650°C, the situation is different, the film-10Al-90ZnO has higher sensitivity, which is most-likely due to the introduction of Al atoms in the crystal structure of ZnO.

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AFM Investigation of GaAs(100) Surface after Oxide Film Removal

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Preliminary structuring of the surface is one of the relevant methods for obtaining ordered arrays of quantum dots A_3B_5. However, not all modern modification methods provide for vacuum transport to the epitaxial growth chamber. In view of this, the surface of the substrates is inevitably oxidized and, accordingly, this leads to a necessary process for thermal desorption of oxide components from the surface, which worsens the morphology of the substrates, and consequently, the area with pre-formed structures. The objective of the work is to study the effect of molecular arsenic flux on the processes of thermal desorption of GaAs native oxide and surface morphology. For this purpose, epi-ready GaAs (001) wafers with a nominal oxide thickness of 3 nm and GaAs epitaxial structures with an oxide thickness of about 1 nm were used. The native oxide was removed in the growth chamber of the MBE in two ways – according to the standard procedure and with the addition of arsenic (As). The morphology was investigated using atomic force microscopy. Analysis of AFM images showed that when GaAs oxide is removed, nanoholes are formed on the surface in the result of the interaction of oxide components with the substrate material. This leads to deterioration of the surface morphology. To compare the modes of oxide removal, such parameters of the obtained structures as average depth and diameter (at surface level) and density were analyzed. For GaAs oxide with a thickness of 3 nm, removed according to the standard procedure, a hole density of 77 μm^{-2} was obtained with medium dimensions: 17 nm (diameter) and 6 nm (depth). The addition of the flux of molecular As leads to a halving of hole density and increasing in their average size: 11 nm (depth), 41 nm (diameter). For the GaAs oxide with a thickness of 1 nm, removed according to the standard procedure, recesses with medium dimensions were obtained: 3 nm (depth) and 30 nm (diameter). The addition of As also reduced the density of the hole by half, but practically did not affect the geometric dimensions: 4.8 nm (depth), 36 nm (diameter). This behavior of the system can be explained by the fact that in the presence of free As in the process of thermal desorption of GaAs oxide leads to the binding of Ga atoms, released due to the thermal decomposition of GaAs on already open areas of the substrate surface, due to which their migration to areas with oxide is hampered and thereby the decomposition reaction of the main component of the oxide (Ga_2O_3) is suppressed. This leads to the fact that in areas of the surface masked by oxide, the process of removing Ga_2O_3 becomes possible only due to the enhanced decomposition of the substrate material, which leads to the accumulation of excess Ga under the oxide. It is followed by the formation of nanoscale droplets and the activation of droplets etching of the substrate material. This explains the presence of less density of holes, but larger in geometric dimensions.

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The Growth of Platinum Thin Layers on Aluminum Oxide Substrate by the Method of DC Cathode Sputtering

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Platinum is widely used in scientific and industrial devices due to its unique mechanical, thermophysical and chemical properties. In particular, because of its high resistance, it is able to withstand mechanical loads in aggressive environments at very high temperatures for a long time. Currently, various approaches to the formation of platinum thin films on the surface of an Al_2O_3 substrate are under development. The heteroepitaxial Pt films were applied as metal electrodes for capacitor development. They were deposited on sapphire Al_2O_3 substrate using the VUP-4 device converted for cathode sputtering. For this purpose, it was developed an ion-plasma or cathode method for producing films of pure metals. The proposed method for obtaining heteroepitaxial Pt films is based on the following technique. A high-voltage discharge is applied at direct current (U up to 10 kV) and the substrate is heated to high temperatures (T_s > 700 °C).

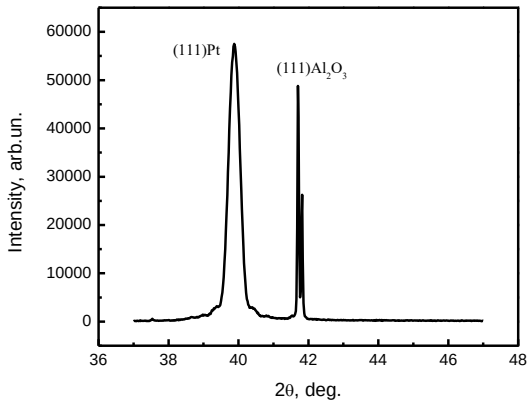

Fig. 1. X-ray pattern of monocrystal Pt(111) // Al_2O_3(1111)

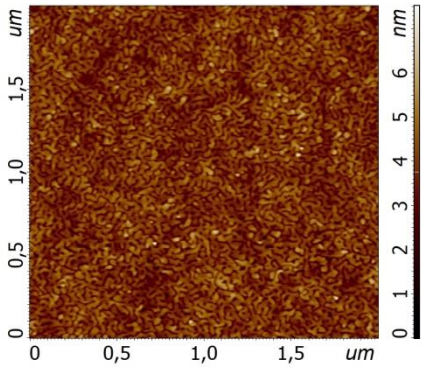

Fig. 2. Micrography of thin film Pt(111) // (1111) Al_2O_3.

According to the data of the X-ray study, it was found that under the conditions of crystallization: U = 6.4 kV, T_s = 675 °C, a distance to the substrate of 19 mm, a pressure in the camera of 6.5 Pa, the crystallographic orientation of the film in respect to the substrate (111)Pt // (1111) Al_2O_3 is realized (see Fig. 1) No reflexes corresponding to other orientations were detected. Figure 2 shows that the mechanism of three-dimensional nucleation takes place during the Pt crystallization. The growth blocks that make up the "labyrinth" are narrow and densely arranged. The average quadratic surface roughness for the Pt//Al_2O_3 film was only 0.7 nm.

Acknowledgements. The work was carried out within the framework of the SSC RAS state task (project number 122020100294-9) with the use of equipment of the Centre for Collective Use No. 501994.

The Growth of Platinum Thin Layers on Magnesium Oxide Substrate by the Method of DC Cathode Sputtering

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Platinum is widely used in devices for scientific and industrial applications. Due to its mechanical strength, heat resistance and chemical inertia, platinum is able to withstand mechanical loads in aggressive environments at very high temperatures for many thousands of hours. Currently, various approaches to the formation of a nanoscale heterostructures on the different substrates are being developed. In this work there were studied heteroepitaxial Pt films, deposited on surface of polished MgO, using VUP-4 device, converted for cathode sputtering. For this purpose, an ion-plasma or cathode method was developed for producing films of pure metals on different substrates. The proposed method for obtaining heteroepitaxial Pt films is based on the following procedure. A high-voltage discharge was applied at direct current (U up to 10 kV) for production of high initial substrate temperatures (T_s > 700 °C). According to the data of the X-ray study, it was found that the realized crystallographic orientation of the film relative to the substrate is (001,002) Pt // (001), (110) MgO (Fig. 1). An increase in voltage caused an increase in the critical temperature of heteroepitaxy. The best films with film orientation (001,002) were obtained under conditions U = 8.4 kV, T_s = 742 °C, distance to the substrate of 20 mm, pressure in the camera of 7.0 Pa. No extraneous reflexes were detected. Figure 2 shows that during the crystallization of Pt, the mechanism of three-dimensional nucleation takes place. The surface relief of the Pt film on the MgO substrate is represented by growth blocks of various shapes that make up the "labyrinth" microstructure of the Pt-film. The average quadratic surface roughness for this film was 2.5 nm.

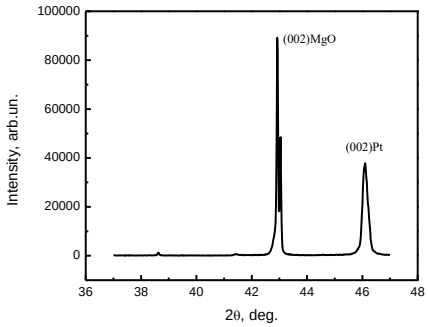

Fig. 1. X-ray pattern of monocrystal Pt(001) // MgO(111)

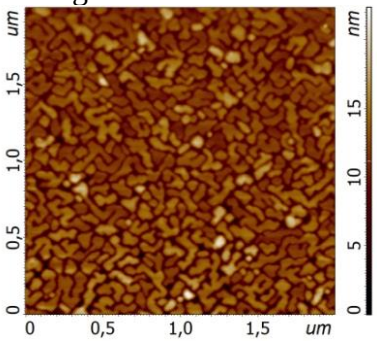

Fig. 2. Micrography of thin film Pt(001) // MgO (001.002)

Acknowledgements. The work was carried out within the framework of the SSC RAS state task (project number 122020100294-9) with the use of equipment of the Centre for Collective Use No. 501994.

Atomic Layer Etching to Obtain a Defect-free Graphene-like Film on SiC

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The aim of this work is to study the production of graphene-like films on a silicon carbide substrate, previously modified with a focused ion beam, using the atomic layer etching method, which can later be used as sensitive elements in gas detection devices. 24 etching cycles were used, during which fluoride plasma and oxygen were used. As a result, an array of 15 structures was formed. Graphene-like films are promising materials for use in micro- and nanoelectronics, in particular, in sensorics due to their unique properties and increased selectivity to certain gases [1]. Methods for obtaining graphene-like films are different, but among them there is a method of atomic layer etching, during which plasma etching cycles are used [2]. In the course of experimental studies on the formation of a graphene-like film, SiC substrates, previously purified and modified by a focused ion beam, were used. According to the simulation results, the gallium ions, remaining after processing, are located at a depth of 5 – 10 atomic layers. To remove them, the method of two-stage layered atomic etching was used. At the first stage, the silicon component was removed in the fluoride plasma, the etching gas flow was 5 cm^3/min. At the second stage, the carbon component was strangled in the oxygen-containing plasma. The etching gas flow was 40 cm^3/min. In the result of the formation of a graphene-like film by atomic layer etching, nanostructures were formed, whose geometric dimensions were 860 nm for height and 900 nm for depth. These nanostructures can be used as a sensing element for gas detection devices.

Acknowledgement. The results were obtained using the equipment of the Research and Education Center "Nanotechnologies" of Southern Federal University.

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Stand for Measuring the Characteristics of the Photoconductivity of Semiconductor Oxide Films

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In order to study the photoconductivity parameters of thin semiconductor films, formed on polycor substrates, a stand was designed and manufactured. The operation of the stand is based on

measuring the pulse characteristics of the photoconductivity of the film under study when it is irradiated with intermittent artificial sunlight. The design of the stand includes a HY30001E (Russia) pulsed DC power supply, which allows one to adjust the energy characteristics of the radiation, a Keithley 2450 source-measuring device (USA), which is used to apply voltage to the test sample and measure the current flowing through it, a Voltmeter B7-78/1, which operates in temperature measurement mode. Radiation with an intensity of 100 mW/cm^2 is produced by a LAMP75/24S halogen lamp (China). To create intermittent radiation, a special electro-mechanical design is used, in which the damper, moving along the guides, blocks the light flow at a given frequency. The damper speed is controlled by a PWM controller. A sample of an oxide material film, deposited on a polycor substrate and contact metallization over the film under study, is placed on a table. The sample is a photosensitive resistor. Electrical contact to the photoresistor is provided by tungsten probes.

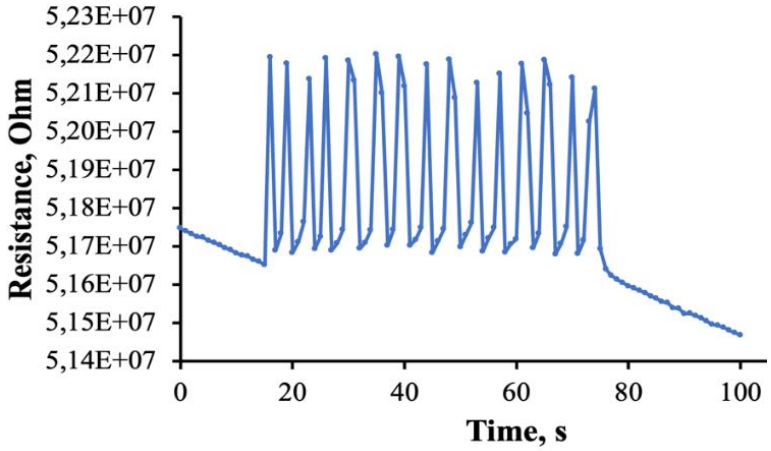

Fig. 1. Time dependence of the resistance during irradiation of a Co_3O_4 film with a halogen lamp.

The bench operation was studied on samples of cobalt oxide (Co_3O_4) films, formed by the method of solid-phase low-temperature pyrolysis [1]. The film thickness was 200 nm. In this work, we studied the direct change in the photoresistance of a sample under the action of light with a controlled emission frequency. Figure 1 shows the time dependence of the measured resistance *R* under irradiation with a frequency of 0.25 Hz. Analysis of the study showed that the absolute change in resistance is, on average, about 500 kΩ, and the relative one is 0.96%. Thus, this stand can be used to study the impulse characteristics of oxide films.

Acknowledgement. The study was supported by a grant from the Russian Science Foundation (project No. 22-29-00621, https://rscf.ru/project/22-29-00621/) at the Southern Federal University.

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Microstructure, Complex Electromechanical Parameters and Dispersion in Porous Piezoceramics

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Porous ceramics are heterogeneous media with unique microstructures that provide original, effective properties on which many different applications are based [1]. In particular, porous ceramics combine general characteristics, associated with the geometry and topology of porous microstructures with the characteristic properties of ceramics as a specific class of materials. The use of porous ceramics is based on their structural and functional properties and characteristics, caused by microstructure, the latter being determined by the initial raw material, composition and method of fabrication. Porous piezoceramics based on different piezoceramic compositions are widely used now in ultrasonic transducers and sensors for various technical applications. However, despite lengthy studies, many aspects of the relationship between the microstructure peculiarities and electromechanical parameters of porous piezoceramics are still unclear. This report presents the results of an experimental study of the microstructure peculiarities, complex electromechanical parameters and their frequency dependences for PZT-type piezoelectric ceramics of the composition $Pb_{0.95}Sr_{0.05}Ti_{0.47}Zr_{0.53}O_3$ + 1% Nb_2O_5 with different relative porosity in the range of 0 – 50 % and average pore size of 10 – 30 μm. The complex elastic, dielectric, and electromechanical parameters of the porous piezoceramics elements were measured at radial and thickness extensional modes of piezoceramic discs using impedance analyzer Agilent 4294A (Agilent Technologies, USA) and the PRAP software. To study the frequency dependences of the complex parameters of experimental samples in the range from 2 up to 20 MHz, we used the previously developed method of analysis of piezoelectric resonance spectra at the fundamental frequency and higher-order resonances of thickness extensional modes. Microstructural studies were performed on polished and chipped surfaces of porous piezoceramic samples, using the scanning electron microscopes (JEOL JSM-6390LA and TM-100, Hitachi). As the result of SEM microstructure analysis, it was found that the following microstructural features of porous piezoceramics define the dielectric, piezoelectric and electromechanical properties of porous piezoelectric ceramics: branched flexible three-dimensional piezoceramic skeleton and quasi-rod piezoceramic structure in the direction of residual polarization of porous piezoceramics [2]. The regions of elastic and electromechanical dispersion, characterized by anomalies in the frequency dependences of the imaginary and real parts of the complex constants of porous piezoceramics were found. It was revealed that the anomalous dispersion of the elastic properties of porous piezoceramics is due to its microstructural features, namely, the presence of a rigid three-dimensional piezoceramic structure and a quasi-rod structure. A change in the ratio of the wavelength of resonant oscillations and the scale of the spatial inhomogeneity of the porous microstructure with increasing frequency leads to an increase in the contribution of the quasi-rod structure to the effective parameters of the porous piezoceramics.

Acknowledgement. The study was financially supported by the Russian Science Foundation (grant No. 22-11-00302), https://rscf.ru/project/22-11-00302/ at the Southern Federal University.

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Finite Element Investigation of Mechanical Properties of Highly Porous Nanoscale Materials with Different Geometry Structures of Gibson-Ashby Cells

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The development of new methods in the field of materials production, particularly 3D printing, has increased interest in the study and modeling of materials with unique properties. For example, highly porous materials can have relatively high rigidity, thermal and acoustic insulation with low density and mass. Moreover, the physical characteristics of such structures at the macro and nanoscale have significant differences. Now there are many mathematical approaches to calculating the effective properties of highly porous materials. The most popular and generally accepted is the Gibson-Ashby model. It is based on a cell made up of thin beams. This model is easy to use and is confirmed by many experiments, but it also has disadvantages. Firstly, it is suitable only for highly porous structures, since the model is based on solving the problem of the beam deflection. It means that when the edge width increases, the model becomes incorrect. Secondly, this model is not universal for cells with different geometric structures. And thirdly, this model does not account of the surface effects that occur at the nanoscale. In this research, a finite element model, based on the Gibson-Ashby cell, is proposed. In this model, the above disadvantages of the analytical model are eliminated. To account for the dimensional effect, the Gurtin-Murdoch model was chosen. It includes surface stresses arising at the boundaries of the cell. The computer model construction, finite element mesh and the numerical solution of the homogenization problem were carried out in the ANSYS software package. Numerical experiments of the model described above of a standard cell have already been carried out. The results obtained numerically and analytically correspond to a porosity of more than 70 %. That results are also confirmed in other papers, since the Gibson-Ashby analytical formula is valid only for highly porous materials. Therefore, the proposed model is correct. In this report, the influence of the cell geometry at a fixed porosity was initially investigated. The obtained results confirm that the effective moduli of highly porous structures composed of Gibson-Ashby cells depend not only on porosity, but also on the geometric configuration. For example, at the same porosity, cells with thicker edges have greater rigidity. Numerical experiments were also carried out at the nanoscale, that is, model took into account surface stresses. The relative stiffness moduli of nanoscale structures are significantly higher than similar values of regular size structures. Moreover, the dimensional effect has a greater influence on the effective properties of a highly porous material than the cell configuration. For example, the relative effective Young's modulus of a regular size structure with thick edges is smaller than that of a nanoscale structure with thin edges. In this report, cells with a complex geometric structure are considered, so a representative volume loses the isotropic properties of the material. Anisotropic properties were determined by the Zener ratio.
Acknowledgement. This research was supported by the Russian Science Foundation, grant number No. 22-11-00302.

The Problem of Nonlinear Optics with the Transformation of a Spatial Variable and an Oblique Derivative

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The initial boundary value problem for a nonlinear parabolic equation with the transformation of the involution by a spatial variable and an oblique derivative on horizontal segments of the boundary of a rectangular region is considered in the form:

$$Lu \equiv u_t - D\Delta u + u - \Lambda Qu = f(u),\ Qu(x,y,t) = u(-x,y,t),$$
$$f(u) = K(1+\gamma\cos Qu) - \Lambda Qu = g(x,y,t),\ \Lambda = -K\gamma\sin\omega,\ t>0,\ |x|<\pi,\ |y|<l, \quad (1)$$
$$u(x+2\pi,y,t) = u(x,y,t),\ u_y(x,\pm l,t) - \mathrm{tg}\alpha\, u_x(x,\pm l,t) = 0,\ u(x,y,0) = u_0(x,y).$$

The separation of variables $(u = Z(x,y)T(t) = X(x)Y(y)T(t))$ leads to the spectral problem:

$$D\Delta Z(x,y) + (-1+\lambda)Z(x,y) - \Lambda QZ(x,y) = 0,\ Z_y(x,\pm l) - \mathrm{tg}\alpha\, Z_x(x,\pm l) = 0. \quad (2)$$

and the equation: $T'(t) + \lambda T(t) = 0$ or $T(t) = C\exp[-\lambda t]$. It is shown that the solution (2) reduces to the problems: $DX''(x) + [-1+\lambda - D\nu]X(x) + \Lambda QX(x) = 0$, $X'(x) - \mu X(x) = 0$, $X(x+2\pi) = X(x)$, $Y''(y) + \nu Y(y) = 0$, $Y'(\pm l) - \mu\ \mathrm{tg}\,\alpha Y(\pm l) = 0$.

The eigenvalues: $\nu_k = \left(\frac{k\pi}{2l}\right)^2$, $k = 1,2,\ldots$ correspond to the eigenfunctions:

$$Y_{2m} = C_{2m}\left[\cos\frac{\pi m}{l}y + \frac{l\mu\mathrm{tg}\alpha}{\pi m}\sin\frac{\pi m}{l}y\right],\ Y_{2m+1} = C_{2m+1}\left[\frac{2l\mu\mathrm{tg}\alpha}{\pi(2m+1)}\cos\frac{\pi(2m+1)}{2l}y - \sin\frac{\pi(2m+1)}{2l}y\right].$$

Depending on the sign $\pm\Lambda$, we get two sets of $\lambda_{nk}^{\pm} = 1 \pm \Lambda + \left[n^2 + \left(\frac{k\pi}{2l}\right)^2\right]D$, to which the functions: $X_n(x)Y_{2m}(y)$, $X_n(x)Y_{2m+1}(y)$ correspond, where $X_n(x) = a_n\cos nx + b_n\sin nx$.

Bifurcation values are the values of the diffusion coefficient *D*:

$D_{nk}^{*} = (-1\pm\Lambda)\left[n^2 + \left(\frac{k\pi}{2l}\right)^2\right]^{-1}$, $n = 0,1,2,\ldots$, $k = 1,2,\ldots$, λ_{nk}^{-} is responsible for stable modes.

Representations for (1) in the form of nonlinear integral equations, convenient for numerical calculations, are obtained. A similar problem for a ring without an operator *Q* is considered in the work of A. V. Razgulin [1].

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Development and Analysis of Methods of Geometric and Strength Calculations of Novikov Gearings

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The analysis is given, and the development from the moment of creation to the present day of approaches to the study of geometry, accuracy, control of teeth and strength of Novikov gears with different hardness of teeth surfaces is shown. In the field of geometry, initial contours have been developed, which are included in the Russian State Standards. Gearings with correction and various methods of tooth control are proposed, the issues of adaptation of gearings to manufacturing and assembly errors are investigated. The main stages of development of methods for calculating the bending and contact strength of teeth are given. The final stage was the creation of a package of computational programs for solving the spatial contact problems for any position of the contact area along the length of the teeth and of modeling multi-pair gearing. The many-years results of comparative tests of Novikov gearings and involute gears with different hardness are given and the advantages of Novikov gearings in terms of load-bearing capacity and service life are shown. Examples of industrial application of Novikov gearings in various branches of mechanical engineering are shown. Novikov gearings with modified teeth that improve the technical characteristics of these gears are described. It is indicated that the most important direction for the further development of Novikov gearings is to increase their accuracy due to the technology development of finishing treatment of tooth surfaces.

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The Alternative to High-precision Involute Gearing

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For the first time, a comparison of the load-bearing capacity of Novikov's nito-cemented gears of the average accuracy without finishing the teeth and high-precision involute gearing with ground teeth is given. It is shown that the load-bearing capacity and service life of Novikov gearings is higher than that of involute gearing gears, and the longitudinal modification of the teeth further improves the technical characteristics of Novikov gearings. The replacement of high-precision and labor-intensive in the manufacture, and therefore very expensive involute gearing with Novikov gearing of medium accuracy will allow in some cases, in addition to increasing the load-bearing capacity and resource of work, to reduce the labor intensity of manufacturing and the cost of drives of machines, produced in various industries, which will favorably affect their competitiveness. The most important direction is the development and improvement of the technology of finishing of teeth and control of high-quality high-hardened Novikov gearings and the corresponding

processing tool. When finishing the teeth of Novikov's gears, we can expect an additional increase in their load-bearing capacity by about 10 % in bending strength and 25 % in contact strength, and with longitudinal modification of teeth, the load-bearing capacity in contact strength will increase additionally 1.6 times.

Acknowledgement. The study was carried out with the financial support of the Ministry of Science and Higher Education of the Russian Federation, the State Task in the field of scientific activity, the scientific project No FENW-2023-0012.

Development of the Control Mechanism of Container Position

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The concept of mechatronics is an important direction in modern engineering science. This study considers the development of a mechatronic device for positioning containers in the process of coupling/uncoupling with a suspension mechanism [1, 2]. The mechatronic device for positioning containers in the process of coupling/uncoupling with a suspension mechanism in the presented work was divided into 5 stages (see Fig. 1).

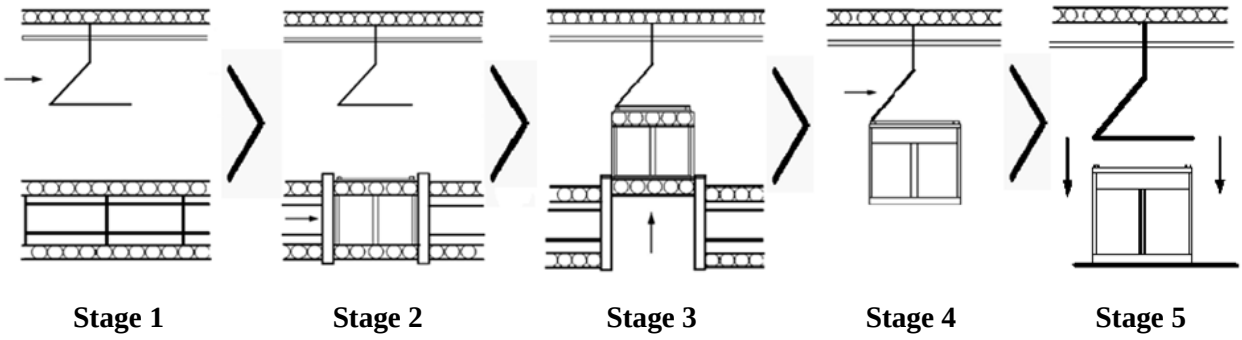

Fig. 1. Stages of the mechanism operation

1st stage: recognition of the movable hitch mechanism in the required coordinates. *2nd stage*: container recognition. To start the coupling/uncoupling process, it is necessary to recognize the presence of the container on the lifting mechanism. *3rd stage*: lifting containers. After recognizing the container and the hitch mechanism at the starting position, the container is lifted using a lifting device that is built into the conveyor line. For this, hydraulic cylinders and hydraulic motors are used. *4th stage*: hitch. At this stage, the container is engaged with the hitch mechanism, the lift returns to its original position and the container moves along the overhead road. *5th stage*: container uncoupling. When the coupling mechanism has arrived at the required place, the container is uncoupled for its further operation or storage. To automate the process of controlling the container position, control system during the coupling/uncoupling process, it could be used a special computer program that will read data from sensors and make decisions, based on the specific parameters. This will significantly improve the efficiency and accuracy of the system, as well as reduce the risk of human error. The structure is shown in Fig. 2. The figure indicates: ДО – optical sensor; ДК – end sensor; D1, D2, D3, D4 – magnetostrictive sensors; 3 – signal about engagement; РДМ – relay motor rollers main road; РДК – relay for conveyor roller motors; РДП 1 – 4 - Relay for lift motors.

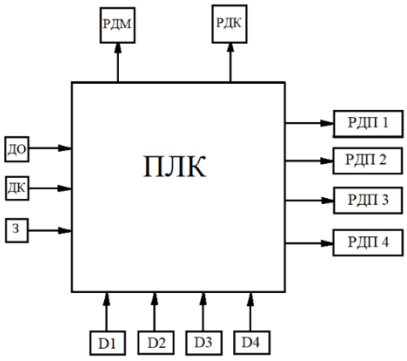

Fig. 2. Structural diagram of the control of the position of the container

Various models of programmable logic controllers (PLCs) can be used to control the container position control system during the coupling/uncoupling process, depending on system requirements and project budget. For this work, the Modicon M221 will do. This PLC has enough computing power for the purposes we need. Sensors are connected using terminals that clamp the connection cable and create a continuous connection loop.

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Improving the Efficiency of the Control System in the Service Area of Universal Containers for the Transportation of Solid Waste

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Issues related to the improvement of the system for the removal of municipal solid waste are relevant due to the constant growth of the population in cities [1]. The most promising direction is the development of technological zones (transport and logistics points) at a small distance from urban buildings. The functions of such zones are solving logistical problems, such as, for example, reloading containers of loaded solid waste from road transport to a cable car, temporary storage of containers before sending them for loading, tracking and correcting the route of containers with various deformations [2]. The development of a system for remote monitoring of the state of containers in the process of moving along within a transport and logistic point (TLP) is the subject of this study. The work of the system under consideration is to track the geometric parameters of containers for transporting solid waste, and, in the case of deviation of any parameter, the container is sent to the repair area. The controlled parameters are the following: (i) geometric dimensions of the container structure as a whole; (ii) geometric dimensions of each element of the container separately; (iii) parallelism of the bearing elements of the container; (iv) integrity of welds. The system operation involves obtaining a large amount of data. To process a large amount of data (Big Data) and to ensure the effective operation of the remote diagnostics system, it is supposed to use computer vision (artificial intelligence technology) to assess the technical condition of the rope during its operation.

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Nanoscale Field Emission Cell with a Blade-Type Matrix Cathode

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The actual task of field emission nanoelectronics is to solve the problems of uneven field distribution at the emission surface of cathodes. Increasing the field emission current is also an important task in the design of cold emission cells. The heterogeneity of the distribution of emission centers on the cathode surface in the presence of high currents affects the durability and stability of electron emission. Several studies have revealed the marginal destruction of blade cathodes. Optimization of the geometrical parameters of the cathode in combination with the use of carbon nanomaterials with increased electrical and thermal conductivity, resistance to ion bombardment, allows us to solve these problems. In this study, a field emission cell, consisting of an array of blade cathodes, based on silicon carbide with a graphene film on the surface, is considered. The aim of the work is to identify the regularities of the distribution of the electric field strength in the interelectrode gap of a field emission cell, containing a blade-type multi-pointed field emission cathode, depending on the parameters of the length and width of the anode. Thus, three-dimensional modeling of the field strength distribution was carried out a field mission cell with a cathode consisting of five blades 500 nm height and 1000 nm length (Fig. 1).

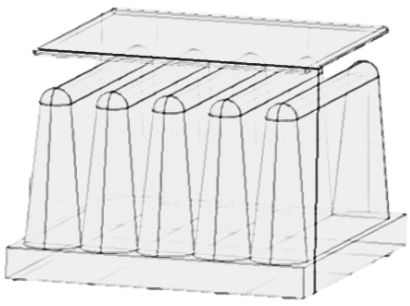

Fig. 1. CAD model of a nanoscale field emission cell

The influence of the width and length of the anode in the range from 800 to 1500 nm has been studied. The uniformity of the field at the emitting surface was evaluated both along the length of the blades, and the comparison of the parameters of all cathode blades with each other. By changing the parameters of the anode, conditions have been identified that ensure a deviation of the electric field strength between the cathode blades both in the central part and at the edge of the blades, less than 0.5 %, which allows us to consider the values equal. It was revealed that the deviations of the electric field strength at the edge of the blade do not exceed 0.18 % of the values

in the central part of the blade. Field uniformity was achieved with an anode width of 913 nm and a length of 890 nm. The results obtained should be considered when designing nanoscale field emission cells with a blade-shaped cathode.

Advantages of Bimetallic Electrocatalysts for Cathodes in a Proton Exchange Membrane Fuel Cell

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One of the most competitive ways to replace internal combustion engines as energy sources for vehicles is the use of fuel cells with a proton exchange membrane (PEMFC). Such devices attract a lot of attention due to the high efficiency of energy conversion, the absence of harmful emissions, low operating temperature and flexible power range. The development of platinum-containing catalysts for low-temperature fuel cells is an actual task of modern electrochemical energy. The transition from Pt/C to Pt*M*/C (*M* = Cu, Ni, Co) reduces the cost of the catalyst and at the same time increases its specific characteristics [1]. The use of various synthesis methods can make it possible to control the microstructure of the resulting catalysts. We have successfully implemented approaches to obtaining materials based on "core-shell" nanoparticles [2]. An important stage in the synthesis of bimetallic catalysts is their acid treatment, which is necessary to prevent the dissolution of the alloying metal during the functioning of the material in the MEA [3]. The obtained results are present in Fig. 1.

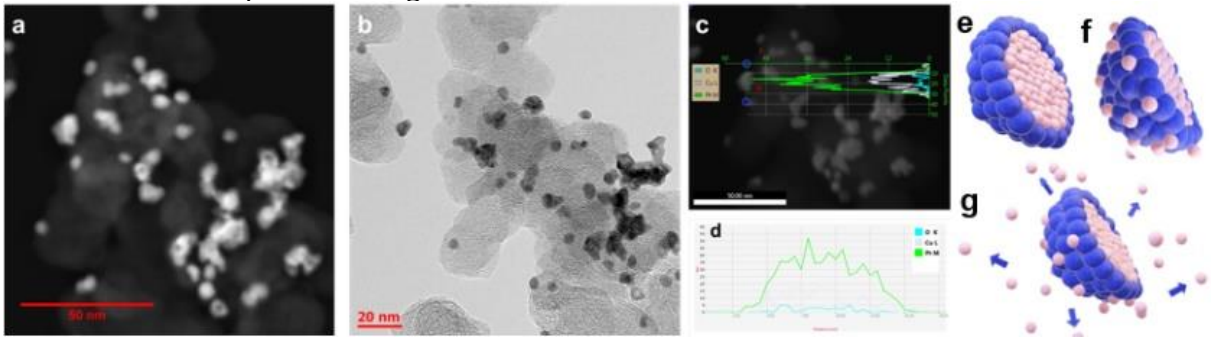

Fig. 1. STEM images (a) and TEM images (b) of PtCu/C electrocatalysts with core-shell nanoparticles structure. EDX line scan of PtCu NPs (c); distribution of elements in a nanoparticle (Pt, Cu, O) (d); ideal representation of a nanoparticle with a "shell-core" structure (e); bimetallic nanoparticle with "shell-core" structure with alloying component atoms on the surface (f); the process of acid treatment of a bimetallic nanoparticle with a "shell-core" structure (g).

Acknowledgement. The study was carried out with the financial support of the Ministry of Science and Higher Education of the Russian Federation (No. FENW-2023-0016).

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Catalytic Acetylene Hydrochlorination over Platinum Chloride Complexes: Computational Insights into the Reaction Mechanism

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One of the ways to obtain information about the mechanisms of catalytic transformations is quantum-chemical modeling of the reaction energy profile. This approach is used to predict the structures of chemical compounds in individual reaction steps and to estimate their energy. An experimental tool for studying the reaction mechanisms is the use of isotopically labeled reagents, which makes it possible to establish the structure of the transition state and the stereoselectivity of the reaction. The combination of theoretical and experimental approaches makes it possible to form a holistic mechanistic understanding of the reaction and can serve as a basis to design new catalytic systems. The subject of this study is the catalytic acetylene hydrochlorination to produce vinyl chloride, a monomer of the large-tonnage plastic polyvinyl chloride. Environmental concerns, associated with the industrial use of a highly toxic mercury catalyst in this process, stimulate the search for alternative eco-friendly catalytic systems for vinyl chloride production. We consider mechanically activated platinum chloride complexes as such a model system. In the catalysis of acetylene hydrochlorination over K_2PtCl_4 complexes by the method of isotopically labeled reagents showed the production of only the product of the trans-addition of chlorine and hydrogen atoms to the triple bond of acetylene, as well as two isotope effects due to the H-Cl bond breaking in two stages of catalytic reaction, the limiting chloroplatination of π-coordinated acetylene and fast protodemetalation of the formed intermediate. Experimental data indicate the absence of the proton tunneling effect in the reaction limiting step and its presence at the protonolysis step. The report will present the results of DFT-modeling for the energy profile of the acetylene catalytic hydrochlorination over mechanically activated platinum chloride complexes. Particular attention will be paid to the calculations of isotope effects and the correlation of theoretical results with experimental data.

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Experimental Measurements Using a Prototype of the Express Analysis System

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The measurements were carried out using an experimental prototype of a system for express-analysis of oxygen saturation and hematocrit, based on a prototype device, as a laser source of excitation of the optoacoustic effect (Table 5.4) [1, 2]. Processing and registration of acoustic

signals was carried out using the installation, presented in [3 – 6]. An example of a registered signal is shown in Fig. 1. Measurements of hematocrit and oxygen saturation were carried out on blood samples taken from patients of different age groups and sexes, namely, men 40 – 80 years old and women 38 – 70 years old. At the same time, these same blood samples were examined in the clinical setting of the diagnostic center.

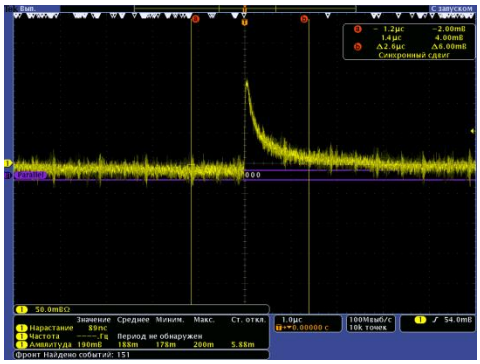

Fig. 1. Photograph of the oscillogram of a single acoustic pulse in a test tube with blood

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Using the Optoacoustic Effect for Express Blood Diagnostics

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In optoacoustic imaging, depth is limited by light penetration and acoustic attenuation. In practice, the incident laser light and the acoustic wave, generated by the light beam, will be attenuated in the tissue. To diagnose tumor growth, it is necessary to monitor the amount of oxygen in the tissue. Tumor development requires a large amount of oxygen and nutrients. Therefore, tumor malignancy can be determined based on microvessel structure and oxygen saturation (SO_2). Pulses with a duration of 84 ns and a repetition period of 10 kHz were formed by a single-mode solid-state NdYAg laser with an adjustable power level from 0.1 to 100 W, which is part of the LIMO

100-532/1064-U measuring setup. The signal amplitude increased by 28 % with an increase in the laser radiation power by 15 %. At the same time, we note that the relaxation time after the heating peak changed, so at a power of 0.085 W the relaxation time was 9.2 μs, and at 0.1 W, it was 18.5 μs (Fig. 1) [1, 2]. One of the key advantages of optoacoustic imaging is that it can be easily implemented on clinical ultrasound devices to extend the scope of traditional ultrasound imaging to cellular and molecular imaging [3 – 5].

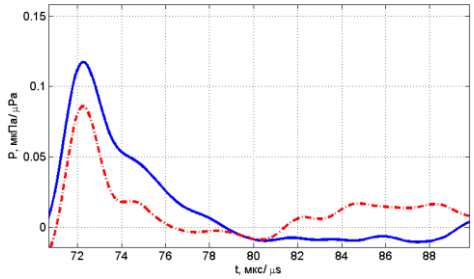

Fig. 1. Acoustic signal registered in an aqueous solution at power: 0.085 W (red dotted line), 0.1W (blue line)

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Optimal Hypocycloidal Profiles of Single Screw Hydraulic Pumps

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Geometric parameters of the rotor and stator cycloidal meshing profile are of great importance for increasing performance and reliability of single screw pumps [1]. The report studies and optimizes the geometric parameters of hypocycloidal gears, used in single screw pumps. A method of calculation of hypocycloidal gearing tooth profiles, based on application of classical formulae of ordinary hypocycloids, equidistantly shifted by a given distance, is proposed. It is shown that application of shortened hypocycloids [2] leads to violations of contact interaction between rotor and stator and necessity of searching for providing such interaction by introducing different coefficients. An original algorithm for analysis of smoothness of parametric curves of tooth profiles has been developed. Two target parameters of research are defined: the area of alive section of the end profile of the working body of gerotor hydraulic machine as the parameter influencing productivity; the smallest reduced radius of contact interaction of a rotor with a stator as the parameter, defining working capacity of the working body of the pump. Methodology for

determination of target and varying parameters for optimization of geometry of end cross-section profile of screw pump is developed. The results of the research showed that when the equidistant displacement of the profile increases, the live cross-section area decreases, and the reduced contact radius reaches the maximum and then decreases. Thus, it is possible to speak about existence of some optimal value of profile parameters by criteria of efficiency and working capacity of working body of the pump. Empirical dependences are defined, allowing to establish optimal values of geometrical parameters of the profile at the stage of designing. It turned out that the introduction of relative values of the roller radius, the live section area, and the reduced contact radius makes it possible, using simple empirical dependences at an early design stage, to obtain absolute values of the same values for any contour radius within the specified ranges. The new methodology allows at the stage of designing the rotor and stator profiles one to get an assessment of the performance and operability of a screw pump. The results of the research can be used in mechanical engineering, when designing single screw hydraulic machines to improve their technical and operational characteristics.

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Optimizing Deposition Regimes to Fabricate $VO_2/TiO_2/c\text{-}Al_2O_3$ Thin Films for Active Metasurfaces

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Vanadium dioxide exhibits a metal to isolator transition (MIT) at ~68 °C, which is controlled by temperature, light, electric current or mechanical strain. Fast MIT with resistance change for ~4 orders of magnitude as well as significant alteration of the transmission/reflection in the near IR (20 – 30 %), middle IR (~60 %) and THz/sub-THz (~40 %) ranges make VO_2 promising for devices of photonics and novel THz/IR optics. VO_2 films grown on single-crystal TiO_2 substrates reveal more mechanical strain in structure, compared to VO_2 films grown on sapphire. Poor matching of lattice constants of the VO_2 film and a substrate result in short VO_2 reverse switching time of ~252 ns [1]. Also, for VO_2 grown on a single crystal TiO_2 substrate the MIT is typically occurred at lower temperature in films of smaller thickness due to lattice strain. However, the high cost of TiO_2 single crystals limits their mass use. We study the properties of VO_2 films of altered thicknesses in the range of 20 – 170 nm prepared on *c*-sapphire substrates with a TiO_2 sublayer by pulsed laser deposition method. Synthesis parameters of TiO_2 film were preliminarily optimized. XRD patterns reveal an epitaxial growth of the VO_2 films with distortion of the monoclinic cell to

hexagonal symmetry. The positions of lattice vibration modes in Raman spectra are similar to bulk VO_2 when the film thickness is greater than ~30 nm. For VO_2 films thicker than ~20 nm a lattice strain is observed as a modes position and intensity change. The electrically triggered MIT transition in a ~50 nm thick VO_2 film reveals forward and reverse switching times as short as 20 ns and 400 ns, respectively, which is quite close to the best-known results for VO_2 films prepared on single-crystal TiO_2 substrates [1].

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Study of Nanohole Formation by Local Droplet Etching for Site-controlled Growth of Symmetrical Quantum Dots

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InAs quantum dots (QDs) obtained by molecular beam epitaxy on GaAs substrates have broad prospects for application in quantum photonic devices due to their unique optical properties. However, for the full implementation of these devices, QDs must have a low surface density to be considered as single objects as well as high lateral symmetry, which can be achieved using the preliminary formation of nanoholes by a method of local droplet etching. In this report, we study local etching of the GaAs (001) surface by Ga droplets at various technological conditions. For the first time, we obtain symmetrical nanoholes of pyramidal shape with a low surface density ($\sim 1\times10^8$ cm^{-2}) on the GaAs (001) surface, which allows subsequent formation of single quantum dots for high-efficiency quantum photonic devices. Analysis of the results shows that 1.1 monolayer (ML) of Ga is not enough to produce droplets capable of etching deep nanoscale areas of the surface. At the same time, in other cases there are arrays of holes with different average diameters, which increase as the amount of deposited material increases. A minimum deposition thickness of 1.5 ML Ga is found to be sufficient to etch the GaAs surface. We also observe that an increase in the annealing temperature from 580 °C to 610 °C leads to a decrease in the depth of the holes from 4.3 to 1.0 nm. Symmetric pyramidal holes with the required surface density were obtained by reducing the background arsenic pressure to values below 1.5×10^{-7} Pa with the annealing at 550 °C during various time periods from 15 to 30 min. Fig. 1 shows AFM and SEM images of the obtained samples, as well as a cross-section of a typical nanohole for two mutually perpendicular directions.

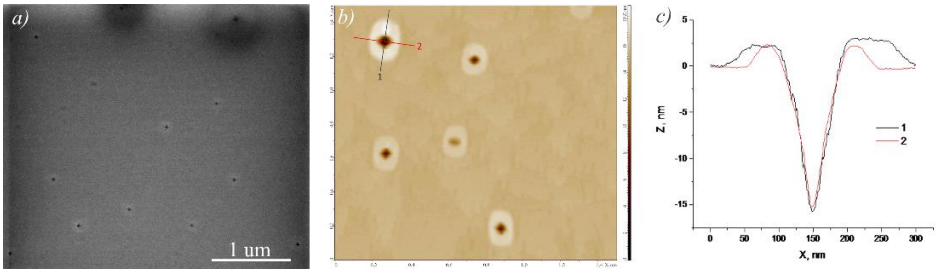

Fig. 1. GaAs surface after etching by Ga droplets at an arsenic pressure of 1.5×10^{-7} Pa and different annealing time: (a) 30 min (SEM image), (b) 15 min (AFM image), (c) AFM cross-sections of the hole in Fig. 1b.

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Simulation of the Structure of PMN-based Samples in the Presence of Oxygen Vacancies

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In recent decades, compositionally and structurally disordered materials have been actively studied, which are considered promising for a wide range of practical applications due to the unusual properties observed in them [1]. The study of the properties and structure of such systems will make it possible in the future to design materials with the required set of physical characteristics. Unfortunately, today there is no clear understanding of the processes occurring in the structure of materials and the established clear relationship between the observed properties and the microscopic mechanisms of processes in these systems. We used the data of X-ray diffraction analysis of single-crystal samples of lead magnoniobate and solid solutions synthesized on its basis. The work is devoted to modeling the distribution of oxygen vacancies in solid solutions, obtained on the base of lead magnoniobate, synthesized on the base of a model ferroelectric-relaxor with a given composition nonstoichiometry $(1 - x)PbMg_{1/3}Nb_{2/3}O_3 - xPbMg_{1/2}Nb_{1/2}O_{2.75}$, where x varied from 0 to 1 in steps of 0.1. As can be seen from the above formula, the samples under study initially have an oxygen deficiency, which means the presence of oxygen vacancies. It was found that the perovskite structure was retained in all samples [2]. The features of relaxor ferroelectrics are due to a random electric field, induced substitutional disorder, the presence of vacancies, and other inevitable defects. Oxygen vacancies in relaxors can strongly affect their physical properties [3]. One of the possible mechanisms to compensate for the missing negative oxygen ions can be the redistribution of cations in the *B*-sublattice or the displacement of ions in the cationic *A*- and *B*-sublattices. Note that vacancies tend to accumulate near any inhomogeneities, surfaces, and interfaces, since the energy of vacancy formation in such places can be much less than in a homogeneous volume. In places, where vacancies accumulate, they can create sufficiently strong fields, which in turn can lead to the appearance of new phases in relaxors, for example, polar (ferroelectric) phases. On the contrary, in places where there are few vacancies, a nonpolar relaxor remains. Thus, in this case, the coexistence of polar ferroelectric and nonpolar relaxor states is possible. The purpose of our study was to elucidate the physical mechanism that may be responsible for the oxygen-vacancy-induced ferroelectricity in lead magnoniobate, synthesized on the base of a model ferroelectric relaxor. Changes in the concentration of oxygen vacancies can provide a new way to manipulate the relaxor properties.

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Structural Order/Disorder Phenomena Investigation in Pb-containing Complex Perovskites with Relaxor Ferroelectric Properties

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Ferroelectrics-relaxors, discovered more than half a century ago, are today actively used materials due to the possession of a unique set of specific physical properties that are absent in conventional ferroelectrics [1, 2]. At present, scientists from all over the world have carried out quite a lot of research that makes it possible to study the macroscopic properties of relaxors in the most complete way. However, an unambiguous picture of the relationship between the observed physical properties and microstructural changes in these objects has not been achieved.

The nature of the observed physical properties is associated with the presence in these objects of random electric fields that arise in the result of the presence of the following reasons. First, it is the observed disorder in *A*- and *B*-type cationic sublattices, which causes local displacements of ions from their usual equilibrium positions [3 – 6]. The second reason for the emergence of random electric fields in recent years is associated with the presence of vacancies in the crystal lattice, primarily in the distribution of oxygen atoms. The study of the influence of the presence of oxygen vacancies and changes in their concentration can indicate a method for controlling the relaxor properties, which will make it possible to characterize the influence of the microstructure and macroproperties of ferroelectric relaxors in a new way. This work presents the results of studying samples, obtained on the basis of lead magnoniobate and described by the general formula $(1 - x)PbMg_{1/3}Nb_{2/3}O_3 - xPbMg_{1/2}Nb_{1/2}O_{2.75}$, where the value of parameter x varies from 0 to 1 with a step of 0.1. Experimentally, it was shown that all compounds from this series of objects are ferroelectric-relaxors. With an increase in the value of the parameter x, the proportion of nonstoichiometric lead magnoniobate with an artificially set oxygen deficiency increased. This work presents the results of modeling the determination of possible sources of random electric fields in the studied samples with nonstoichiometric compositions based on the distribution of Mg/Nb atoms in the *B*-sublattice and/or due to a change in oxygen vacancies because of a predetermined oxygen deficiency.

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Lead-free Multiferroic Composite Ceramics Based on Barium-Calcium Zirconate-Titanate and Modified Nickel Ferrite

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In recent years, the attention of researchers has been attracted by lead-free multiferroic compositions, both single-phase (for example, bismuth ferrite and solid solutions, based on it and related systems [1, 2]) and heterogeneous (particularly, ME composites, based on barium-calcium titanate-zirconate $Ba_{0.85}Ca_{0.15}(Zr_{0.1}Ti_{0.9})O_3$, BCZT)), due to limitation on the Pb-containing materials, used in electronic equipment and other areas, because of lead toxicity. In this report, lead-free ME composite ceramic (100 − *x*) wt.% $Ba_{0.85}Ca_{0.15}Ti_{0.9}Zr_{0.1}O_3$ (BCZT) + *x* wt.% $NiCo_{0.02}Cu_{0.02}Mn_{0.1}Fe_{1.8}O_{4-d}$, (NCCMF), without any impurity phases, as well as signs of interfacial interaction at the doping level, was obtained by the solid-state method [3]. Ceramics has a high electrical resistivity at direct current (~10^9 Ω·cm) and demonstrates a combination of magnetic and piezoelectric properties in the entire *x*-range, which vary over a wide range and naturally depend on the composition of the composites (see Table 1). The maximum ME coupling coefficient $\Delta E/\Delta H \approx 90$ mV/(cm·Oe) has been observed for specimens with *x* = 60 – 70 wt.%. The saturation magnetization and remanent magnetization of these specimens are, respectively, ~22 and ~0.5 emu/g, the coercive force is ~30 kOe, the dielectric constant at room temperature at a frequency of 1 kHz and 1 MHz is ~90 and ~70, respectively, for x = 60 and ~55 and ~40 for *x* = 70. The dielectric loss tangents at the indicated frequencies are 0.4 – 0.5 and ~0.03, respectively. The piezoelectric coefficient for specimens with *x* = 60 and 70 is 16 and 9 pC/N; the piezoelectric voltage constant is 16.3 and 14.3 mV·m/N, respectively. The obtained lead-free ME ceramics is not inferior in terms of piezo parameters and ME coupling efficiency to materials of the lead zirconate titanate group previously obtained by the solid-state method [4]. Moreover, the obtained lead-free ME ceramics even slightly exceed the lead-containing analogues in terms of piezoelectric parameters.

Table 1. Properties of ME composite ceramics (100 − *x*) wt.% BCZT + *x* wt.% NCCMF

x	M_S, emu/g	M_R, emu/g	H_C, Oe	log R	$\varepsilon/\varepsilon_0$	tan δ	d_{33}, pC/N	g_{33}, mV/(m·N)	$\Delta E/\Delta H$, mV/(cm·Oe)
20	3.8	0.32	46	9.2	709	0.09	37.2	6.1	22.5
30	8.5	0.43	43	9.5	365	0.11	33.6	10.4	49.9
40	9.7	0.65	42	9.8	324	0.12	22.0	10.8	52.6
50	13.0	0.50	34	9.1	155	0.33	18.6	13.5	81.1
60	17.4	0.52	31	8.8	113	0.55	16.3	**16.3**	**89.7**
70	21.0	0.52	30	7.9	71	0.89	9.0	**14.3**	**90.6**
80	23.8	0.50	28	8.5	46	0.77	5.3	13.0	70.7
90	31.0	0.36	20	7.7	44	0.99	2.2	5.5	50.0

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Complex Studies of $BiFe_{1-x}(M_{1/2}Ti_{1/2})_xO_3$ (M = Co, Ni, Zn, x = 0 – 0.11) Multiferroics

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Perovskite-like rhombohedral distorted solid solutions of $BiFe_{1-x}(M_{1/2}Ti_{1/2})_xO_3$ (M = Co, Ni, Zn, x = 0 – 0.11) were obtained by solid-phase synthesis [1]. With the growth of x, the angle α of the rhombohedral unit cell $BiFe_{1-x}(M_{1/2}Ti_{1/2})_xO_3$ increases slightly and does not depend on the nature of the alloying cation, parameter a changes in accordance with the ionic radii of the mixed cations $(M_{1/2}Ti_{1/2})^{3+}$. In systems with cobalt and nickel content, parameter a decreases (in a system with nickel, the decrease is stronger), and in a Zn-containing system, a naturally increases. Solid solutions of $BiFe_{1-x}(M_{1/2}Ti_{1/2})_xO_3$ (M = Co, Ni), in contrast to $BiFe_{1-x}(Zn_{1/2}Ti_{1/2})_xO_3$ demonstrate ferromagnetic hysteresis pels at room temperature (see Fig. 1). With an increase in x in the range from 0.01 to 0.11 in the $BiFe_{1-x}(M_{1/2}Ti_{1/2})_xO_3$ system, the saturation magnetization M_S (from ~0.1 to ~0.4 emu/g) and the remanent magnetization M_R (from ~2.4×10^{-3} to ~0.038 emu/g) increases, while the coercive force H_c decreases from ~120 to ~80 Oe. In the $BiFe_{1-x}(Co_{1/2}Ti_{1/2})_xO_3$ system, noticeably higher values of magnetic properties and their more complex dependence on x are observed. The maximum values of the magnetic parameters are observed at x = 0.04 – 0.05: M_S = 0.83 and M_R = 0.24 emu/g, H_c = 1.8 kOe. The detected anomalies in the properties of Co-containing solid solutions are presumably related to the one-ionic magnetocrystalline anisotropy of Co^{2+} cations. Samples of $BiFe_{1-x}(M_{1/2}Ti_{1/2})_xO_3$ (M = Co, Ni) demonstrate piezoelectric activity: the piezoelectric constant d_{33} averages 3.5 – 5 pC/N, up to 7 pC/N on individual samples and can be attributed to high-temperature multiferroics according to the set of properties.

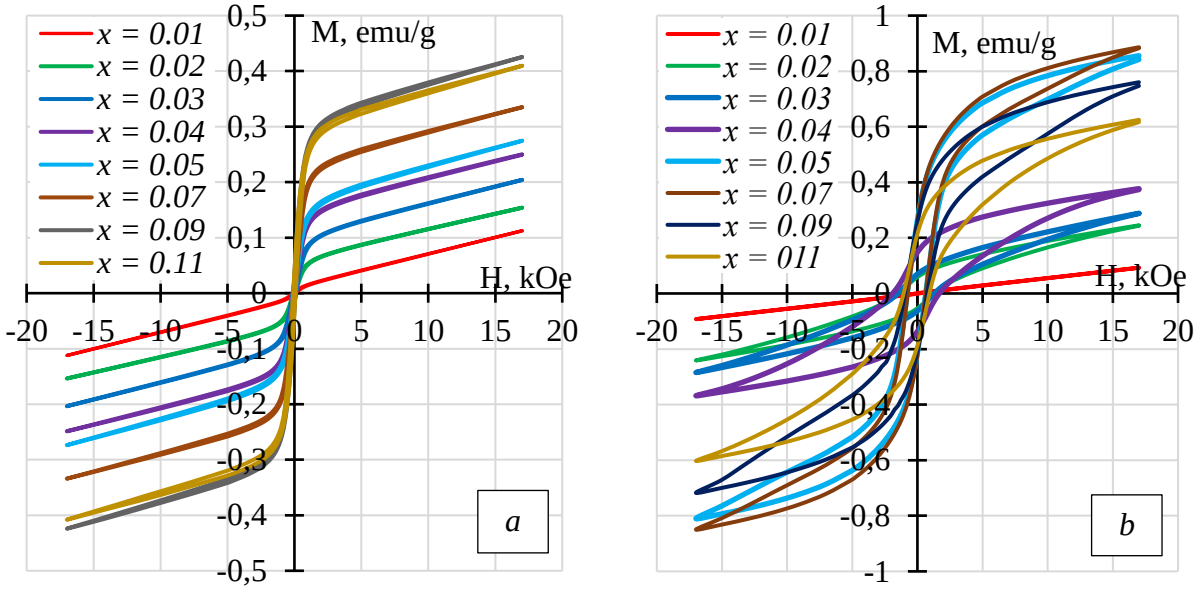

Fig. 1. M–H loops for $BiFe_{1-x}(\mathbf{Ni}_{1/2}Ti_{1/2})_xO_3$ (a) and $BiFe_{1-x}(\mathbf{Co}_{1/2}Ti_{1/2})_xO_3$ (a) samples

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Strategy to Attract the Interest of Tourists to Visit Historical Places

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Pari Temple is a classic Indonesian heritage, located in Candipari Village, Porong District, Sidoarjo Regency, East Java Province. The location is about 2 km to the northwest from the center of the Lapindo Mudflow. According to the stone inscribed above the gate, this temple was built in 1293 Saka (1371 AD). This stone is a relic of the Majapahit era during the reign of King Hayam Wuruk (1350 – 1389 AD). This temple was discovered on October 16, 1906 by the Dutch East Indies colonial government. This temple was restored in 1994 – 1996 by the Regional Office of the Ministry of Education and Culture and SPSB East Java.This temple is a rectangular building made of bricks, facing west with a garden and a gate made of andesite stone. The purpose of this study is to describe Pari Temple specifically and explain to readers that Pari Temple is one of the best destinations to visit. This research was conducted using the method of collecting information and observing data. There are several suggestions for Pari Temple, namely more access to tourist attractions and providing a wider parking area, promoting Pari Temple to more people so that historical places in Sidoarjo become iconic places to visit and preserving history in the Sidoarjo area with government assistance Sidoarjo; maintaining the increasingly fragile shape of the temple while maintaining the pari temple according to the sop, and more to show the uniqueness of the temple so that many people come and are interested in visiting the Pari temple, the government can modify the surroundings of the Pari temple by holding a bazaar or having local art so that many people are interested in visiting the Pari temple.

Molecular Dynamic Study of Dependency on Mechanical Characteristic of Nanocrystalline Copper over Various Temperature and Strain Rate

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Nanocrystalline copper is one of the best-suited materials for integrated chip industries due to its high mechanical stability and lower resistivity. In the present work, the molecular dynamic simulation approach is employed to analyze the mechanical properties and potential energy of single crystal nano copper. The response of temperature, as well as strain rate on selective properties, has been explored. Nanocrystalline copper deformation under a virtual uniaxial tensile test has demonstrated that the increase in strain rate from 1.0×10^{8}/sec to 5.0×10^{10}/sec provides a significant change in the mechanical properties of nano copper. In addition, the outcomes reveal that the mechanical properties of crystalline nano copper degraded with temperature response

under uniaxial tensile loading. With increasing temperature from 50 K to 500 K, the potential energy response shows an increase in the instability of the structure at higher temperatures. The results may help to accelerate functional applications of nanocrystalline copper at high temperatures, subjected to a different levels of strain rates.

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Automation of the Wastewater Treatment Process from Oil Products

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Wastewater treatment from oil products is necessary to protect the environment and keep it clean [1]. Petroleum products such as oils, gasoline, diesel fuel and others are dangerous pollutants of aquatic ecosystems. Getting into water sources, oil products form spots on the surface of the water, kill microorganisms and fish, which are the main elements of the ecosystem [2]. In addition, contaminated water can adversely affect the health of people who use such water for drinking, watering plants, or other purposes. Therefore, wastewater treatment from oil products is a mandatory measure for protecting the environment and maintaining its purity [3]. The choice of treatment method will depend on the type and degree of contamination of the wastewater, as well as on the operating conditions and available resources to perform the treatment [4]. Automation of the wastewater treatment process from oil products is carried out using special technological systems that allow achieving maximum efficiency in work and significantly reduce labor and material costs. There are also special automatic systems that can continuously monitor the quality of wastewater treatment and automatically adjust the treatment process, which reduces the amount of waste and reduces the cost of wastewater treatment [5]. Thus, automation of the process of wastewater treatment from oil products is an effective solution to reduce the cost of treatment and improve the quality of wastewater.

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Comparison of the Productivity of Seasoning Processing PT. Smart Furniture

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PT. Smart Furniture is a company, engaged in the production of furniture (tables). Based on the analysis conducted, the company's productivity index has fluctuated (up and down). Wrong one reason is the unstable productivity of the cutting machines (J, K, and L machines). Improved productivity for every company must be able to continue survive and thrive in the face of increasingly fierce competition. Productivity is an important criterion, considered in an increasingly business environment competitive. From benchmarks of productivity, we can know how efficient and effective a company uses this resource to produce output. In this study, to measure the level of productivity of companies, we used the Marvin E. Mundel method with the measurement period in 2017. There was an increase in the productivity index in 2017, compared to 2016 on 0.5 %. There was an increase in output returns capital (AP/1) in 2017, compared to 2016, namely Rp. 51,736,404. Moreover, there was increase in labor output (AOP/3) in 2017, compared to 2016, which was Rp. 6,306,811.

Comparison of Leakage Currents in Single-layer and Double-layer Thin-film Structures

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An important characteristic for the application of dielectric thin films is the leakage current. Depending on the external conditions of a device with a metal-dielectric-metal (MDM) structure, the mechanisms of electrical conductivity and thus the values of leakage currents may change [1]. By combining layers of thin films with different mechanisms, it is possible to reduce the leakage current. This report presents a comparison of currents in thin films of $Sr_{0.6}Ba_{0.4}Nb_2O_6$ (SBN), $Ba_2NdFeNb_4O_{15}$ (BNFNO), as well as their combination. The measurements were carried out at room temperature using TF Analyzer 2000 E (see Fig. 1). It is assumed that due to the different prevailing mechanisms of film conductivity, as well as the contact potential difference between the layers, such a significant change in leakage occurs by two orders of magnitude, compared with single-layer samples.

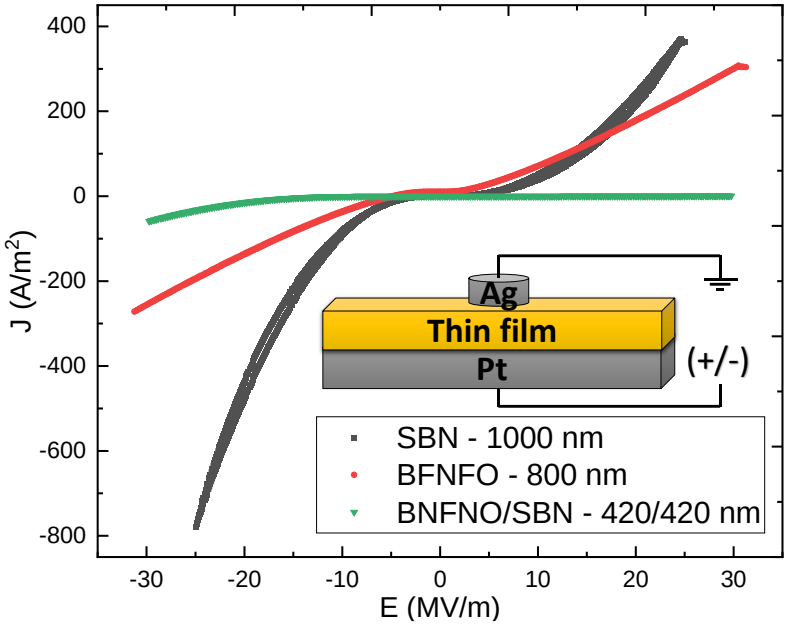

Fig. 1. Dependence of the leakage current density on the field strength in coordinates *J* – *E* (a), Poole – Frenkel (b), Schottky (c), SCLC (d)

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Warm Solutions Using Waste from Thermal Power Plants

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The long heating season in many regions of Russia, as well as modern building regulations, rising energy prices, have significantly increased the requirements for the overall thermal resistance of enclosing structures for reconstructed and newly built buildings and structures. It is almost impossible to meet these requirements by increasing the thickness of the enclosing structures. Based on these conditions, building envelopes should be built from highly porous materials: foam concrete, aerated concrete, highly porous ceramics. However, the construction of structures from these materials is most often carried out using a conventional cement-sand mortar with an average density of 1600 – 1800 kg/m^3. Due to this, significant heat losses occur during the heating season through the “cold bridges”, formed by such solutions. In this regard, the question arises of the use of so-called “warm solutions”. The average density of such solutions should be comparable to the density of highly porous wall materials, that is would be in the range of 500 – 1000 kg/m^3. These mortars must have appropriate strength and durability, and the mortar mixture must have normalized values of mobility, water-retaining capacity, as well as plastic strength sufficient to absorb the load of the overlying parts of the building during the initial period of hardening in the mixture in the masonry. The minimum grades of mortars for masonry walls should be in the range from M10 to M50. Thus, a warm solution with the required strength characteristics should have

the lowest possible average density, which can be achieved by creating a highly porous structure [1]. This kind of material structure can be obtained by porous cement stone or by using the light aggregate. Based on the foregoing, this report presents a study of the possibility to obtain warm solutions, based on ash microspheres and fly ash from thermal power plants [2]. Such a filler has significant advantages over traditional ones: the phase composition is represented by glass phase and mullite, closed porosity, low density, spherical shape, particle size distribution and granule size (20 – 200 μm) make it possible to obtain a material of a high degree of uniformity. For this filler, compositions of optimal structure and various purposes were developed, with a density of 500 – 1100 kg/m^3, and strength grades M35 – M150. The use of warm solutions for these aggregates makes it possible to effectively use the advantages of highly porous wall materials to reduce heat losses and the weight of enclosing structures, and also to solve environmental problems of waste disposal.

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Dry Waterproofing Mixture for the Protection of Structures

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During operation, the structural elements of buildings and structures often contact with a variety of aggressive environments, which can lead to their premature destruction. In this regard, the study of scientific and practical issues of protection of building structures and materials from corrosion remains an urgent task in the field of construction. One of the promising directions in this area is the development and application of elastic insulation, which, unlike traditionally used insulating materials, has significant advantages. Since most of the main roll materials and bituminous mastics have restrictions on their use in winter, their laying requires a dry base, from an environmental viewpoint, the use of such materials causes certain harm to the environment. Traditional materials work optimally under static impact, but when dynamic impacts occur, cracks, breaks, and delamination occur in the insulation, which ultimately leads to the loss of protective properties. Modern coatings made of elastomeric materials are significantly superior to the material of "hard" insulation in terms of their performance (they have high frost resistance, durability, resistance to aggressive environments, manufacturability of application and repair). As part of research work, a two-component composition of elastic waterproofing has been developed, which consists of a dry mixture and a modifying resin. The dry mixture is selected from mineral binders, fractionated mineral fillers, chemical additives. The modifying resin is a 50 % dispersion, based on copolymerization products of acrylic acid ester and styrene. Before use, both components are mixed until a homogeneous mixture is formed. The prepared composition should be used within 0.5 – 1 hour. The composition is applied in continuous and uniform layers without gaps and sagging. The developed composition is applied manually with a fly brush, brush or rubber spatula in 2 – 3 layers. The recommended layer thickness is 1 – 1.5 mm. The protective waterproofing coating is characterized by high adhesion (more than 1.0 MPa) to organic and inorganic substrates, high elasticity (relative elongation in tension not less than 100 %), flexibility on the beam (with a

radius of 5 mm) within minus 30 – 40 °C, has no shrinkage, provides the W8 water resistance mark, has increased weather resistance, biostability and resistance to aggressive environments. The resulting mixture can be used for materials of almost any porosity, as well as applied to a wet surface. It provides a high degree of reliability of surface protection even in the presence of a large quantity of protruding parts, irregularities, kinks, junctions, feeders, communication inputs. It allows one to perceive multiple dynamic loads without violating the integrity of the waterproofing carpet.

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Accounting the Effective Mass Change of Charge Carriers Drifting in the High Mobility Semiconductors Bulks for Applied Calculations of Output I–V Characteristics

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Within the framework of the phenomenological model, the equality, obtained in the result of the Taylor series expansion of the function $1/m = f(W)$ with the restriction of this series to the second term [1, 2], is applicable: $\frac{1}{m} = \frac{1}{m_0}\left(1 - p_m \frac{W-W_0}{W_0}\right)$. The dimensionless parameter p_m is defined from the drift characteristic of the semiconductor and depends on its type [2, 3] (so for *n*-GaAs: p_m = 0.1) (see Fig. 1). Substituting the equations for the values of kinetic energy W and quasi-pulse p [1]: $dp/dt = eE - p/\tau,\ dW/dt = eEp/m - (W - W_0)/\tau_э$ into above expression and reducing it to the normalized form, taking into account the parameter $E_п = m_0 W_0 / e^2 p_m \tau \tau_э$ is the intensity of the electric threshold field of the Gunn effect, we obtain [2]: $E/E_п = \sqrt{m/m_0 p_m (W/W_0 - 1)}$ an equation that will allow us to estimate the degree of influence of the intensity of the external electric field on the electron kinetic energy (see Fig.1).

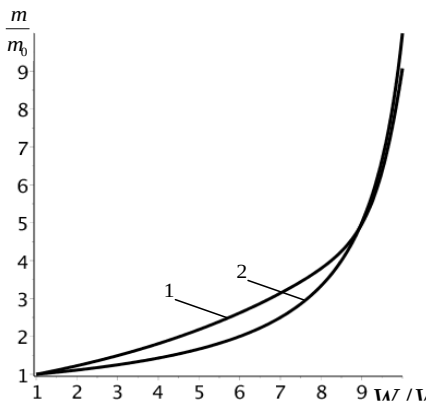

Fig. 1. Effective mass energy dependences, constructed according to: 1 – the classical dispersion method [3] and 2 – the obtained relation

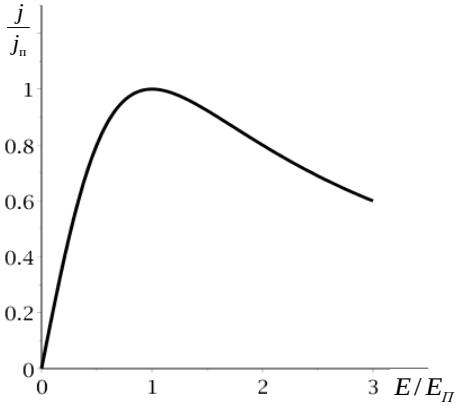

Fig. 2. Normalized *I* – *V* characteristic

The density of the output current: $j = en\mu E = e^2 n\tau/Em$ can be determined taking into account $1/m = f(W)$ and, after the introduction of the normalizing parameter: $j_{\text{п}} = en\mu_0 E_{\text{п}} = e^2 n\tau E_{\text{п}}/2m_0$ $(\mu_0 = e\tau/m_0)$, for the stationary case of the heating equations and the drift, it can be obtained: $\frac{j}{j_{\text{п}}} = \frac{E}{E_{\text{п}}}/\frac{m}{m_0} = 2\frac{E}{E_{\text{п}}}/\left(1 + \frac{E^2}{E_{\text{п}}^2}\right)$. The obtained ratio can be applied both in analytical and in other computational models (Fig. 2). The extremes of this function are defined as: $j/j_{\text{п}} = 1$ при $E/E_{\text{п}} = 1$, that is this dependence is analogous to the drift characteristic, which is manifested for all bulk semiconductor structures, made of $A^{III}B^{V}$ type materials, which makes it possible to apply the obtained relations in any practical studies.

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On the Question of the Using Chiral-like Inclusions Advantages in the Transmission Line Substrates Composition

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In practice, elements that are configuratively oriented in the form of chiral-like structures are most often used as part of the dielectric substrates bulks of microwave transmission lines [1].

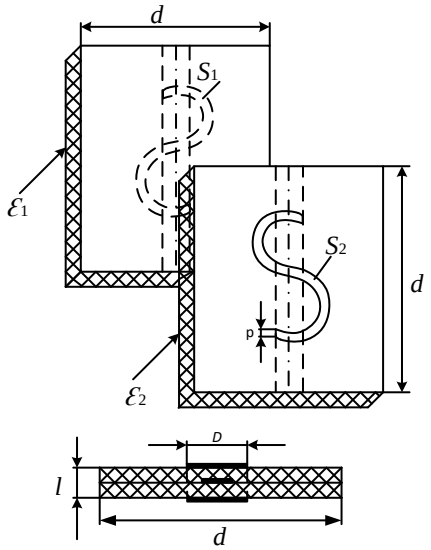

Fig. 1. Sketches of the transmission line section according to the PPF type

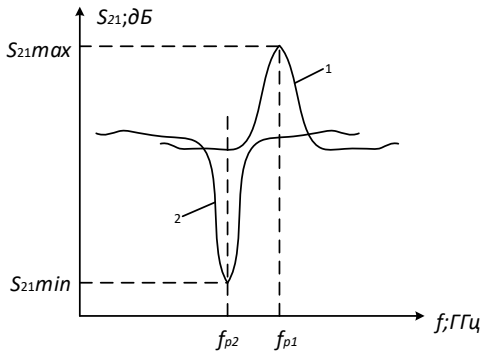

Fig. 2. Frequency characteristics of the transmission coefficient S_{21}: 1 – for conventional RTF; 2 − for the notch RTF

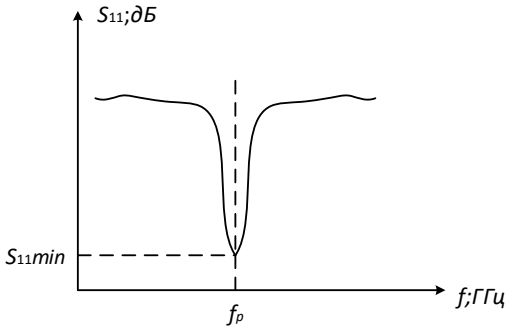

Fig. 3. Frequency response of the reflection coefficient S_{11} from the input port

This determines their main advantage as additional inclusions that provide a significant improvement in the receiving and transmitting parameters of antennas and reflecting elements [2]. The following are the main criteria that must be taken into account when designing such nodes, using the example of a single-pass gammadions pair arranged symmetrically on the surface of the transmission line substrate with a transmitting plane passing inside Fig. 1 (topological dimensions are shown in the sketches).At these sizes, it is necessary to strive to maximize the parameter S_{21} of this quadrupole and minimize the reflection coefficient from the input (S_{11}), which determines the following conditions: $l \approx \lambda/2,\ D \sim \lambda/2$ (in this case, a change in the type of polarization is possible), $p \ll \lambda$. In addition, for homogeneous substrates $\varepsilon_1 \approx \varepsilon_2 \approx \varepsilon$ one should strive to fulfill the resonant properties for the above parameters (Figs. 2, 3) of the RTF. Obviously, with such consideration, it is necessary to strive to ensure that the condition is met: $f_p = f_{p1}$ (or $f_p = f_{p2}$). This will ensure full absorption of the incident and maximum transmitting power due to the of gammadion inclusions chirality effect.

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Capabilities of Consolidated Sintering Methods for Manufacture of Multilayer Packet Piezoelectric Actuators

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Piezoelectric materials with low sintering temperatures for the manufacture of multilayer actuators with a low-voltage control voltage are of great practical interest. A prerequisite is the need to match the sintering temperatures of the ceramic layers with the firing temperature of the conductive electrodes. The aim of the work was to correct the properties of piezoelectric

ceramics by changing the conditions for the formation of the microstructure at a constant chemical composition. The microstructure, density, hardness, and strength are set at the stage of piezoceramic sintering, and the future electrical parameters of piezoceramics depend on the sintering conditions. Of particular interest are the methods of hot pressing (HP) and spark plasma sintering (SPS), which have a great influence on the formation of the microstructure of piezoelectric ceramics. Three objects of study were chosen:
(i) relaxor ferroelectric material PCR-12 based on the PZT system ($0.36PbTiO_3 – 0.33PbZrO_3 – 0.17Pb(MgZn)_{1/3}Nb_{2/3}O_3 – BaTiO_3 – SrZrO_3$), with improved properties of electromechanical transformation;
(ii) ferrosoft piezomaterial of system $(1 – x)Pb(Mg_{1/3}Nb_{2/3})O_3 – xPbTiO_3$ (PMN – PT), with high electrophysical properties;
(iii) multicomponent soft ferroelectric material $PbTiO_3 – PbZrO_3 – Pb(Ni_{1/2}W_{1/2})O_3 – Pb(Cd_{1/2}W_{1/2})O_3 – Pb(Bi_{2/3}W_{1/3})O_3 – Pb(Ni_{1/3}Nb_{2/3})O_3 – Pb(Zn_{1/3}Nb_{2/3})O_3$) (CLS-80), with a sintering temperature of less than 1000 °C.
The main characteristics of the materials studied in this work, obtained by various sintering methods, are presented in Table 1.

Table 1

Compound	Sintering method and temperature, °C	Density, g/cm^3	tan σ, %	$\varepsilon^T_{33}/\varepsilon_0$	d_{31}, pC/N	d_{33}, pC/N
PMN-PT	1250 °C, ATM	7.50	0.5	1643	235	500
	1180 °C, HP	7.77	0.7	1778	241	550
	1150 °C, SPS	7.92	0.4	1789	187	380
PCR-12	1200 °C, ATM	7.3	0.50	4318	327	720
	1175 °C, HP	7.4	0.70	4378	334	750
	970 °C, SPS	7.7	0.49	3580	322	603
CLS-80	980 °C, ATM	7.81	1.98	2910	227	530
	960 °C, HP	7.76	2.18	2698	182	480
	930 °C, SPS	8.13	2.2	2919	237	560

It has been established that the SPS method is preferable for sintering CLS-80 piezoceramics, while the HP method is most suitable for CLS-80 and PCR-12 ceramics. The considered methods lead to the formation of a dense defect-free microstructure, which provides an increase in the main electrophysical and mechanical characteristics at low temperatures. This has a positive effect on energy saving and increases the efficiency of piezoelectric ceramics of various functional groups.

Plasma-chemical Processing of Semiconductor Wafers for the Formation of Nanosized Metasurfaces

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In the course of the work, the etching modes of silicon in a combined plasma discharge for the formation of optoelectronics structures were investigated. The formation of ordered silicon nanoscale structures occurs using the fluoride combined plasma treatment method. So, for

example, according to experimental data, with a structure height of 245.2 nm. the roughness was 1.56 ± 0.1 nm. The verticality of the obtained structures varied from 10 to 35 degrees. Currently, the field of optoelectronic industry is actively developing. Silicon is now actively used as a substrate [1]. One of the promising methods of surface treatment is photolithography followed by plasma chemical etching [2]. In this regard, an urgent task is to study the effect of processing modes in a combined discharge plasma on the parameters of the formed nanoscale structures. For the experiments, silicon plates with one type of *n*-Si conductivity with a crystal lattice orientation (100) and a resistivity in the range of 0.001 – 0.005 Ω/cm were used. The substrates were chemically cleaned in acetone and isopropyl alcohol in order to strangle impurities and organic residues. After that, a local masking coating of SPR-220 photoresist, characterized by plasma resistance, was formed on their surface by photolithography. Fluorine atoms and SF5 radicals (partially) served as active particles during silicon etching. In experimental studies, structures with a height of 245.2 nm, a roughness of 1.56 ± 0.1 nm and an angle of inclination of the structure of 21.2° were obtained. Consequently, the dependence of the height of the structure on the power of the inductively coupled plasma source has a linear character, which is associated with an increase in the degree of ionization of the fluorinated gas and the ion energy in the plasma with an increase in the power of the ICP source. Based on this, with an increase in the power of the capacitive plasma source, the angle of inclination of the wall of the structure decreases due to a decrease in the anisotropy of the process. In the result of experimental studies, structures with a maximum roughness of 11.3 ± 0.8 nm were formed for a structure of 182.7 nm. A 245.2 nm structure with a minimum roughness of 1.56 ± 0.1 nm was also formed. In the work, structures with a wall inclination angle from 10° to 35° were obtained. These structures can be used in the microelectronic industry and in the field of optoelectronics and photonics.

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Simulation of Phase Transition in the Process of Cryopreservation of Biological Material

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The paper considers the development of a new technology for intelligent control of low-temperature preservation of reproductive fish cells. In particular, such a technology can be used for sturgeon fish. At the equilibration stage, for better penetration of the cryoprotectant inside the cell, a special piezoactuator creates acoustic waves in the suspension (mixture of fish germ cells with cryopreservative) [1 – 3]. The next step is the diffusion of the cryoprotectant through the cell membrane. By considering the current variety of models of intracellular transport of substances, it is accepted that the corresponding diffusion coefficients are pre-determined from biological experiments. The report builds a mathematical model of suspension freezing, taking

into account the temperature jump at the boundary between the solid and liquid phases. The type of this boundary is determined by the crystallization temperature. The difference of thermal-physical properties of liquid and solid phases in the regions, where the temperature is above and below the phase transition temperature is taken into account. The mathematical model is an initial-edge thermal conductivity problem, in which the heat capacity and thermal conductivity change by a jump at the phase boundary. In addition, surface heat sources, which characterize its release during crystallization, are taken into account at this boundary. For the numerical analysis, a program in the finite element package FlexPDE was developed. In the program, the surface heat source is replaced by a narrow bulk Gaussian distribution, which can be used to simulate the blurring of the phase transition surface. In the numerical experiment, a cylindrical vessel with thin walls with a room temperature suspension is placed in liquid nitrogen. The upper lid of the vessel is made of insulating material. We consider a non-stationary axisymmetric problem for a circular cylinder with a constant temperature at the lower end and lateral boundary (deep freezing temperature in liquid nitrogen –195.75 °C), the upper lid is thermally insulated. Over time, the entire volume of the suspension passes into the solid phase. The interfacial boundary begins to move from the boundaries at which a constant temperature is set. The temperature distribution over the volume of the cylinder for different moments of time is investigated. The data obtained can be used to control the low-temperature preservation of reproductive cells.

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Determination of the Strength of Hand-Formed Bricks in Axial Compression

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One of the main ways to control the strength of bricks is the axial compression test. The results of these tests are taken into account in the design of buildings and structures, which means that the errors of these experiments should be minimized [1]. These tests are carried out under the

assumption that the bricks are in a linear stress state. However, the appearance of contact frictional forces between the brick surface and the press plates causes a complex three-dimensional stress state, which is confirmed by the fracture pattern of the specimens. Thus, the simplified model of the tests under consideration leads to a distortion of the strength indicators. Identification of all conditions and factors influencing the stresses and test results and their analysis is an actual practical task. The use of different methods of pre-levelling is especially relevant for hand-formed bricks [2]. Due to the peculiarities of production the bed of such bricks is characterized by great heterogeneity and the presence of surface defects. Such deviations from the even surface are not considered as brick defects but it requires to fulfil the decorative function of the product, for example to imitate ancient masonry. Thus, in the result of applying different alignment methods, the contact surface of the tested samples will be significantly altered, which in turn will inevitably lead to a distortion of the measurement results. For example, the high strength of specimens aligned by grinding is due to a significant change in their contact surface, which also makes it difficult to form an objective assessment of their quality. Based on the studies [3, 4] the influence of friction forces between the brick bed and the press plates on the output strength characteristics of hand-formed bricks was established. According to the results of the experiments, the most optimal methods of surface preparation for tests have been determined.

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Nanostructure of the SBN-60/Pt/MgO(110) Film Fabricated by RF-cathode Sputtering

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At present, thin films and, namely thin films of ferroelectrics are increasingly used in various microelectronic devices. One of the promising materials is strontium barium niobate (Sr,

Ba)Nb_2O_6, a ferroelectric relaxor with the structure of tetragonal tungsten bronze. A $Sr_{0.6}Ba_{0.4}Nb_2O_6$ (SBN-60) film with a thickness of ~180 nm was fabricated by RF-cathode sputtering on single-crystal MgO(110) substrates with a preliminarily deposited Pt layer. It was established by X-ray diffraction that the film is a polycrystalline textured. Surface topography studies were performed on an Ntegra Academia atomic force microscope, using an NS15/50 silicon cantilever in the semi-contact mode. The size of the scanned surface areas was 2×2 μm^2. Processing and analysis of AFM data were carried out in the "Image Analysis" program. An analysis of the surface morphology did not show the presence of pores and cavities in the studied film (see Fig. 1). The root-mean-square roughness of the film surface was ~ 23.6 nm. The surface of the sample is represented by numerous growth blocks, predominantly with oval shape. The average size of growth blocks was larger than 110 nm, which indicates an island mechanism of film growth.

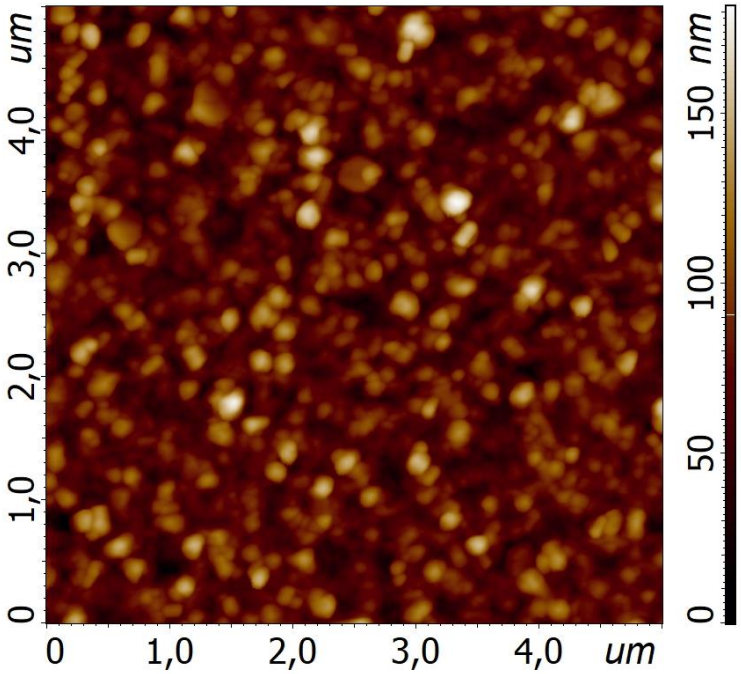

Fig. 1. Film surface topography of SBN-60/Pt/MgO(110) film.

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Automated Control System for Actuator Valves on Oil and Gas Pipelines via Satellite and Cellular Communication Channels

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Valve control in oil and gas pipelines is an important part of pipeline safety and efficiency. Actuating fittings include valves, gates and actuators that control the flow of oil or gas through the pipe [1]. Remote control of actuator valves on oil and gas pipelines via satellite and cellular

communication channels is a system that allows one to control actuator valves on oil and gas pipelines from anywhere in the world using satellite or cellular communications [2]. This system has a set of advantages over traditional valve control methods:
(i) remote control allows control of valves without the need for direct observation;
(ii) remote control allows one to quickly respond to accidents and problems on oil and gas pipelines;
(iii) remote control can significantly reduce the risks, associated with the use of mechanical valves.
The key elements of a remote-control system for oil and gas pipelines are a satellite or cellular telecommunications channel and control and monitoring devices, installed at pipeline transport facilities [3]. In addition, a professionally trained team of technical specialists is required for the successful functioning of the system [4]. In conclusion, note that remote control of actuated valves on oil and gas pipelines is a modern and effective way to control technological processes in the oil and gas industry, which allows one to ensure a high level of safety and reliability of oil and gas pipelines [5].

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Analysis of Factors Affecting Construction and Demolition Waste Generation in Surabaya City

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The development of the industrial sector in Indonesia is growing, even in the city of Surabaya, the second largest city in Indonesia, where many construction projects are underway in

Surabaya, whether they are building projects, roads and bridges. The development of the current construction sector is not spared from generating more construction waste. To reduce and manage this waste, it is necessary to understand the factors that cause construction waste. This study aims to identify the factors affecting construction and demolition waste in the construction industry in Surabaya. Causes of construction waste were identified through a literature review and grouped into several categories of causal factors. To determine the importance of each factor, a structured questionnaire survey was conducted to collect information from contractors on the causes of construction waste. The questionnaire survey results will be used to rank the causal factors for construction and demolition waste.

Assembly and Investigation of Electrochromic Devices

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Lithium niobate ($LiNbO_3$) is an inorganic material with ferroelectric and electro-optical properties. In this study, lithium niobate is prepared by hydrothermal method for the preparation of electrochromic devices. All the electrochromic materials were deposited layer-by-layer by magnetron sputtering to complete the assembly. The effect of adding oxide protective layers on the performance of the electrochromic devices is discussed. Electrochemical workstations were used for cyclic voltammetry and Chroamperometry. Electrochromic elements with a metal oxide protective layer are found to have better optical modulation after coloring and bleaching than those without a metal oxide protective layer. After several cycles of coloring and bleaching, the degradation rate of the electrochromic elements with the metal oxide protective layer was significantly better than that of the electrochromic elements without the metal oxide protective layer.

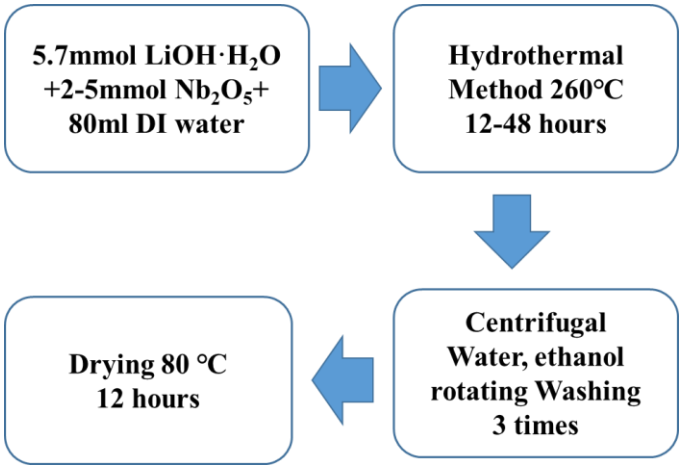

Fig. 1. Formulation for the synthesis of NbO_3 by hydrothermal method

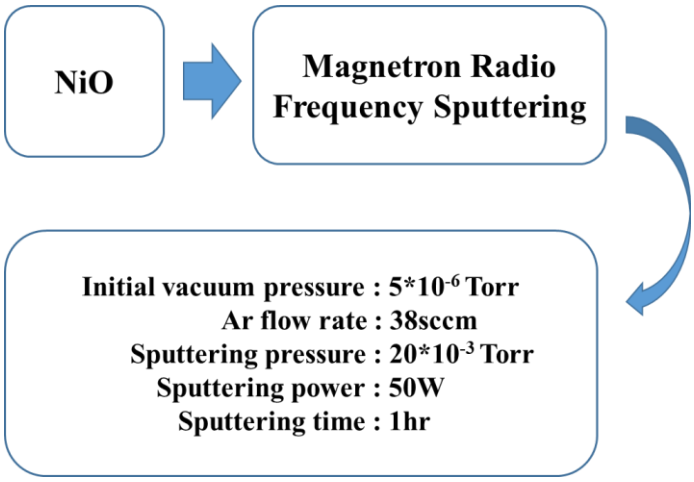

Fig. 2. Deposition parameters of NiO

Figure 1 shows the hydrothermal preparation of lithium niobate, using lithium hydroxide (LiOH) and niobium pentoxide (Nb_2O_5) as initial reactants. LiOH and Nb_2O_5 were added to 80 ml of deionized water and stirred for about 10 minutes. The solution was transferred to a Teflon liner and placed in a stainless-steel autoclave for hydrothermal treatment. The hydrothermal treatment was maintained at 260 °C for 12 – 48 hours and then allowed cooling to room temperature. The synthesized product was removed, washed alternately with deionized water and ethanol, and then centrifuged, and the process was repeated three times. Finally, the samples were dried at 80 °C for 8 h to obtain lithium niobate powder. The structure and morphology of lithium niobate were analyzed by XRD and SEM. Figure 2 shows the deposition process of NiO. This deposition is carried out by magnetron RF sputtering. The NiO target is obtained by a cold pressing process and has a diameter of 2 inches.

Biochar and Engineering Applications in Removal of Heavy Metals from Wastewater: Characteristics, Environmental Benefits towards Sustainable Development Goals (SDGs)

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Urbanization and industrialization have critically contributed to negatively impacting the environment and society. Environmental pollution of heavy metals (HMs) is an increasing concern and has become a challenge worldwide. Biochar has recently gained attention in the environmental sector as a green and alternative material for wastewater removal, increasing the efficacy for sustainable development. This work provides an overview of the remediation of various HMs by biochars and gives a treatment alternative for ecologically sustainable. Owing to its huge SSA and micropore structure, biochar can be utilized for several environmental

services. Applying biochar in WWTPs can eliminate hazardous HMs contaminants, highlighting an environmentally friendly and low-cost. Biochar and engineering applications are also considered alternative solutions, based on the circular economy approach toward sustainable development goals (SDGs). Furthermore, the existing gaps and suggestions for future perspectives are well discussed.

On Expanding the Functionality of Optical Interference Meters to Measure the Displacements of Control Object Surfaces

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Optical interference devices for measuring the displacements of control object surfaces are known, described in detail, justified and published in [1, 2]. In [1], an optical interference device for measuring small displacements of the control object surfaces is proposed, based on the optical scheme of a two-way laser interferometer with combined branches. The mentioned technical solution makes it possible to provide contactless measurements of small linear and all angular movements of the surfaces of the objects of control. In [2], Optical interference device for measuring the displacements of the control object surfaces is described, which implements the method of highlighting the control object surface with a laser interferometer (or the "luminous point" method). This technical solution makes it possible to provide contactless measurements of small linear displacements and adjust the range of measured displacements without changing the optical circuit and its components. One of the interesting options for expanding the functionality of the means [1, 2] is their constructive unification while preserving the functionality and distinctive features of each of them. A new technical solution has been proposed to solve this problem. The concept, scheme and description of this technical solution have been developed, which allows combining the positive qualities of known technical solutions [1, 2]. The proposed technical solution is intended to create promising means for measuring the displacements of control object surfaces in instrumentation, mechanical engineering, aircraft engineering, etc.

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Some Features of the State Diagnosis of Layered Structures, Manufactured of Isotropic and Transverse Isotropic Materials by Using the Acoustic Active Methods of Nondestructive Testing

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It is known that by diagnosing the state of layered structures made of isotropic and transversally isotropic materials by acoustic active methods of non-destructive testing, the problem of recognizing the results obtained arises. The noted problem is caused by the influence on the results of diagnostics of the structure of the layers and the physical and mechanical characteristics of the materials of the layers. Based on the method of scalarization of dynamic elastic fields in transversally isotropic media [1], new methods and software have been developed for determining the stress-strain state in layered structures made of isotropic and transversally isotropic materials under influences simulating the typical process of diagnosing the state by acoustic active methods of non-destructive testing. The mentioned methods and software take into account the position of the axes of the material symmetry of the materials of the layers [2]. The use of the proposed methods and software in numerical modeling of typical processes of state diagnostics by acoustic active methods of non-destructive testing in the structures under consideration allowed us to identify characteristic features that must be taken into account, when recognizing diagnostic results obtained in practice. The identified features can be used to analyze the results of diagnostics of the condition of the structures under consideration during research and development work in instrumentation, mechanical engineering, aircraft construction, shipbuilding, etc.

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Measurement of Productivity in PT Citra Cakra Mahardika Using OMAX (Objective Matrix) Method

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PT Citra Cakra Mahardika is a company that is actively trying to increase its productivity, among others, by applying the OMAX (Objective Matrix) method. From data collection and analysis, 6 productivity criteria were obtained, with a productivity index from January to December 2022, compared to 2021, namely: 120% in January, 179 % in February, 157 % in March, 157 % in April, 119 % in May, 140 % in June, 163 % in July, 84 % in August, 134 % in September, 182 % in October, 155 % in November, and 99 % in December. After looking for the causal factors, using the fishbone diagram, 14 causal factors were obtained for criterion 1, 9 for criterion 2, 15 for criterion 3, 5 for criterion 4, 9 for criterion 5, and 4 for criterion 6. By using the CTQ method, one can it is known that the causal factors have two largest percentages in each criterion so that 20 suggestions could made for improvement, which can eliminate the occurrence of talk on productivity at PT Citra Cakra Mahardika plant C.

Reducing Defect in the Production Process

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The manufacturing process is complex and prone to defects at various stages of production. Product defects can occur due to a variety of reasons, such as errors in design, materials, manufacturing, or quality control processes. The first step in managing product defects is to identify the cause of the defect. This may involve analysing customer feedback, conducting quality checks, and measuring the performance of components and materials. Once the cause of the defect is identified, corrective action can be taken to prevent further occurrences. One effective method for preventing product defects is through the implementation of a comprehensive quality management system. This system should include clear design specifications, standardized processes for manufacturing, through quality checks at each stage of production, and detailed record-keeping. Another way to reduce product defects is connected with implementing statistical process control (SPC), which involves monitoring production processes to identify and correct deviations from predetermined conditions. By detecting and correcting such deviations in real-time, SPC enables manufacturers to reduce variability and prevent defects before they occur. Overall, managing product defects is an essential part of the manufacturing process. By implementing comprehensive quality of management systems and

utilizing tools such as statistical process control, manufacturers can significantly reduce the occurrence of defects and ultimately improve the quality of their products.

Application of AHP Method for Supplier Selection

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An analytical hierarchy process (AHP) is a method to dissolve a complex, unstructured situation into several components in a hierarchical order by giving a subjective value to the significance of each variable and determining which variable has the highest priority in order to influence the outcome of the situation. AHP (Analytic Hierarchy Process) method, where there are 3 main factors, developed for the project, namely technological, economic, and quality factors with 9 main criteria The decision-making process basically consists of choosing the best alternative. Such as structuring questions, determining alternatives, settling probability values for random variables, value fixers, time preference requirements, and risk specifications. In the selection of spare parts suppliers in various companies, there is a lot of consideration and the need for the right decision-making. Suppliers are physical or juridical persons, who are capable to consistently and effectively deliver the spare parts a company wants. Therefore, there is a need for a very effective method or way to advance in the aspect of selecting suppliers to supply spare parts. The method applied here is the AHP method to choose these suppliers.

Management of B3 and K3 Management Systems, PT. Ispat Indo

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PT. Ispat Indo is the second-largest steel producer in Indonesia. PT. Indo is a Penanaman Modal Asing (PMA) form, located in the industrial area of the village of Kedungturi, Kecamatan Taman, Kabupaten Sidoarjo. The plant produces various types of steel products with a capacity of up to 700,000 metric tons per year. PT. Ispat Indo has a production line for billeting steel raw materials into steel wire and rolling in the form of wire rods. The water used in the steel melting process comes from the water treatment plant (WTP). In the manufacturing process of rolled steel wire or wire rod products, the raw materials of scrap and sponge, as well as additional materials such as ferrosilicon and ankerfrit, will be processed using two processes. The two processes, namely steel melting shop (SMS) and rolling mill (RM), both have several production lines to produce B3 waste. The B3 waste will then be collected at the B3 temporary disposal site (TPS) and handed over to third parties. In the rolling mill process of wire rods manufacturing, it will also produce water-shaped waste, which is used for the cooling process in the wire rod manufacturing process, also called the waste water process. Next, waste water will be treated at

the waste water treatment plant (WWTP). At the waste water treatment unit, the treated water will be reused for the next production process, and the sludge will be collected at the B3 temporary waste station (TPS).

Using the AHP (Analytic Hierarchy Process) Method to Determine the Seafood Menu 88

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The Analytical Hierarchy Process (AHP) method is a mathematical approach, used to assist decision making in complex situations by involving various criteria and alternatives. In the context of the food industry, AHP can be applied to facilitate the optimal menu selection process by considering various factors. This study aims to apply the AHP method to determining the seafood menu at Seafood 88 restaurant. In this case, the criteria considered include delicacy, availability of raw materials, production costs, popularity, and sustainability. The first step in this research was collecting data through surveys and interviews with culinary experts, customers and raw material suppliers. Furthermore, the data were analyzed using the AHP method to obtain the relative weight of each criterion and sub-criteria, obtained from the respondents' responses. The results showed that delicacy was the main criterion in determining the seafood menu at Seafood 88 restaurant with the highest relative weight. Availability of raw materials and production costs also have significant weight. Sustainability and popularity, while important, carry less weight in decision making. Based on the results of AHP analysis, several optimal seafood menus are proposed for Seafood 88 restaurant. These menus combine high delicacy, good availability of raw materials, and affordable production costs. In addition, these menus also consider sustainability by choosing environmentally friendly raw materials. This research provides a practical contribution to the Seafood 88 restaurant in optimizing their seafood menu selection. By using the AHP method, restaurants can consider various important factors in decision making, thus increasing customer satisfaction, operational efficiency, and business sustainability.

Implementation of the Linear Programming Method to Determine Nutrition Requirements

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Linear programming is a method for obtaining optimal results from a mathematical model, composed of linear relationships. Linear programs are a special case in mathematical programming (also known as mathematical optimization). More formally, a linear program is

an optimization technique for linear objective functions with the constraints of some linear equations and linear inequalities. The feasable region of the constraint is a convex polytope, that is, a defined set of intersections of many (but finite) half spaces. While objective functions are real-valued (linear) functions, defined on the polytope, a linear program algorithm will be developed for a point on the polytope that causes the objective function to produce the smallest (or largest) value, if such a point exists. The purpose of this study is to determine the minimum expenditure by ensuring nutrition is met using linear programming by considering the limited cost of the amount of nutritional needs to ensure nutrition composition can be met. Optimization is carried out using the linear programming method by applying LINGO software to determine the optimization of costs incurred. Optimization with a linear programming approach is to maximize or minimize the goal function that depends on a number of input variables. Optimization was determined using 7 decision variables, namely the amount of rice (X_1), the number of chickens (X_2), the amount of tofu (X_3), the number of vegetables (X_4), the number of eggs (X_5), the number of bananas (X_6), and the amount of milk (X_7). The 7 types of nutritional needs in the form of protein, fiber, carbohydrates, calories or energy, vitamins, fat, and calcium present a set of the function of constraints. The formula to determine the minimum value of expenditure is Min = $5{,}000X_1 + 15{,}000X_2 + 3{,}000X_3 + 4{,}000X_4 + 2{,}000X_5 + 1{,}000X_6 + 5{,}000X_7$. The objective value is found by the output. The result of using the LINGO program is 31,000. It can be concluded that the minimum expenditure to meet nutritional needs is Rp. 31,000.

Putting in Place a Method of Transportation to Deal with the Problem of Wood Pallet Shipments

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A wood pallet company has 4 factory locations, namely in Jakarta, Bekasi, Jogjakarta, and Semarang, with a capacity of 55,000 units, 65,000 units, 60,000 units, and 80,000 units, respectively. The production of the five factories are distributed to 6 marketing destinations, namely regions 1, 2, 3, 4, 5 and 6. The demand for the 6 regions is 60,000 units, 35,000 units, 45,000 units, 50,000 units, 20,000 pieces and 50,000 pieces, respectively. Let us define the decision variables X_{ij} as the number of units of product or goods, sent from the *i*-th source to the *j*-th destination. The company's goal is to minimize the costs that must be incurred by the company to distribute products from the warehouse to the marketing area. Then it can be written as follows: Min = $300X_{11} + 250X_{12} + 120X_{13} + 550X_{14} + 860X_{15} + 750X_{16} + 450X_{21} + 350X_{22} + 700X_{23} + 210X_{24} + 520X_{25} + 320X_{26} + 790X_{31} + 880X_{32} + 600X_{33} + 300X_{34} + 270X_{35} + 860X_{36} + 580X_{41} + 560X_{42} + 300X_{43} + 880X_{44} + 770X_{45} + 750X_{46}$. A method of transportation is a method used to regulate distribution from sources of the same or similar commodity or product to a destination with the aim of minimizing the incurred transportation costs. This distribution is done in such a way that requests from several destinations can be met from several points of origin, each of which may have different demands or capacities. Taha in Fitri (1996) suggested that the transportation model seeks to determine a plan for the transportation of goods from a number of sources to a number of destinations. The calculation of the global solution is found

with a minimum cost of IDR 76,050,320. The total iteration used is 11. The variable values are known, namely: X_{11} = 5,000, X_{21} = 20,000, X_{22} = 35,000, X_{24} = 10,000, X_{34} = 40,000, X_{35} = 20,000, X_{43} = 45,000, X_{16} = 50,000, From the calculation results, then it is necessary to find out the optimal solution, using Lingo Software. The results obtained using SoftwareLingo are worth IDR 5,745,000, by sending products from Jakarta to area 2 and area 6 of 5,000 and 50,000 pcs, respectively; from Bekasi to area 3 and area 4 of 45,000 pcs and 20,000 pcs, respectively; from Jogjakarta to area 1 of 60,000 pcs, and from Semarang to area 2, area 4, and area 5 of 30,000 pcs, 30,000 pcs, and 20,000 pcs, respectively.

Using the Integer Programming Method to Calculate the Minimum Production Costs and Dietary Requirements

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Integer programming (IP) is an optimization method used to find optimal solutions in combinatorial problem solving. Combinatorial problems often involve making decisions that consider specific constraints and goals, such as resource allocation, scheduling, and route optimization. In IP modeling, decision variables are expressed as integers, which provides flexibility in achieving solutions that meet established criteria. Integer linear programming is another solution that can be used. However, due to its linear nature, integer programming imposes stricter constraints on the mathematical model of the problem. In this study, to meet nutritional needs and minimize costs, it was used the ILP method with the help of LINGO. It is known that in this problem there are 7 decision variables, namely X_1 = Rice, X_2 = Chicken, $X3$ = Tofu, X_4 = Vegetables, X_5 = Eggs, X_6 = Bananas, X_7 = Milk. Objective function value with protein requirements included: X = 3; Y = 8; Z = 27; protein: 5X grams (53); fiber: 2Y grams (28); carbohydrates: 2XZ grams (237); calories/energy: 15XY kcal (1538); vitamins: 1 mg; fat: 2Z grams (27); calcium: 1XYZ mg (1387), which can be used as the value of the right-hand side of the existing constraints. The results obtained from the LINGO output are indicated by an objective value of IDR 55,000 and the variable values are X_6 = 10 and X_7 = 9. So, to minimize costs, 10 units of banana and 9 units of milk are necessary.

Productivity Analysis and Improvement Using Objective Matrix (OMAX) in Injection Line Production at Pt. Innoware Indonesia

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PT. Innoware Indonesia is manufacturing company that produces plastic packaging products. The number of customer complaint for delays in delivery of products, forced the company to

find the root cause of this problem. So, this study is doing to determine the cause of the decreasing productivity that resulted the delays of delivery product. OMAX is a method used to measure a productivity value of production activities. To get productivity value by using this method, it needs to calculate contribution of each criterion, and also performance indicator measurement. This research consists of the data during one semester, obtained from that archive data and direct interviews with the personnel, related to the production process in injection line, about the obstacles that obstruct productivity. OMAX calculation is obtained based on the results from October 2015 to March 2016. The lowest performance indicator calculation result is seen in the fifth ratio score, that is the comparison between actual production result and production capacity with the score 10. The main cause of the low value of fifth ratio is found by lesser support of machine, personnel, method, material, and environment that leads to machine suddenly stop work. To correct the situation, it was introduced a suggestion that can be applied and useful to solve the problem. Some improvements are focused on improving the quality of human resources and machine, additional facilities, minimizing the waiting time for material, updating the work method, the potential reduction of miss communication.

Productivity Analysis Using Marvin E. Mundel Method (Study Case in UD. Sabar Jaya Malang)

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The development of fruit chips industry requires improvement of competition power continuously. Competition between companies is measured from the level of productivity of the company. UD. Sabar Jaya is one of the fruit chips industry that is growing rapidly in Malang. UD. Sabar Jaya has not been taking measurements of productivity. Companies only measures productivity based on profit. Therefore, UD. Sabar Jaya needs to take measurements of productivity. Marvin E. Mundel method was used to measure of productivity by focusing on production costs as input data (machine depreciation costs, materials, labor, machine maintenance as well as energy consumption and utilities) and output data are the results of cost of the sales of fruit chips. The productivity measurement showed that the highest partial productivity index in the period of measurements in May 2013 are, respectively, 127.43% for depreciation of machine, 329.79% for material, 127.43% for labor, and 142.23% for energy consumptions and utilities, 171.54% in November 2012 for machine maintenance. The lowest productivity index values in June 2013 are, respectively, 37.54% for depreciation of machine, 37.54% for labor, 41.89% for the energy and utilities, 33.61% in December 2013 for the material, 59.76% in May 2012 for machine maintenance. The highest total productivity index was reached in May 2013 and equal to 216.12%; the lowest index was in December 2013 and equal to 43.71%. The productivity should be improved with a tool that is a causal diagram. Based on the results of the measurement and evaluation of productivity at UD. Sabar Jaya, productivity improvement should be based on keeping maintenance of production machinery, increasing supervision of employees, increasing control of the materials sent by the supplier, and others.

Application of the AHP (Analytic Hierarchy Process) Method for Determining Cane Quality

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A new system has been developed which is implemented in a decision support system. This is used to help simplify data processing in determining the quality of seasoned sugar. Whole data collection related to determination of quality of Tumbu Sugar includes color data, taste data and data violence. The method used for data processing uses Analytic Hierarchy Process (AHP). The stages in the AHP method begin with the statement process of the problem, creating a hierarchical structure that is preceded with general objectives, followed by criteria and alternative choices. Then, a matrix of pairwise comparisons is formed with normalization of data, calculation of eigenvector values and testing their consistency. Finally, the eigenvectors of each pairwise comparison matrix are calculated, testing the consistency of the hierarchy. If criterion CR < 0.100 is broken, then the assessment must be repeated. The results of the research show the application of a decision support system that is used to determine the quality of this spiced sugar. It can perform calculations with the AHP (Analytic Hierarchy Process) method faster than manual calculations so that it can be more efficient and the level of accuracy of the data is already close to perfect.

Modern Technologies to Product Polypropylene

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Polypropylene is one of the most important thermoplastic polymers with high thermal and chemical resistance and is widely used in industry. Polypropylene was created in 1951 and is currently one of the most widely used polymers in the world [1]. The technological process of obtaining polypropylene begins with the preliminary preparation of raw material, namely propylene. The raw material is purified from impurities and distilled into the reactor, where the polymerization of monomers takes place. As a result, a polymer mass is formed, which is subjected to additional processing, that is stabilization and granulation [2]. Process control begins with quality control of raw material (propylene). It must meet certain standards in order for the resulting polymer to be of high quality. Before starting the operation of the reactor, it is necessary to conduct a thorough check of its condition and the correctness of the settings of all parameters [3]. One of the main aspects of process control is the control of the temperature regime inside the reactor. It must be fine-tuned and constantly maintained at the desired level. It is also necessary to control the pressure and flow rate of the reaction mass, as well as to continuously monitor parameters that can affect the quality of the resulting product [4]. In addition, it is necessary to control the stabilization process of the polymer mass. It is important that the optimal conditions for this operation are selected since the quality of the final product

directly depends on the stability and accuracy of the stabilization stage. Thus, the management of the technological process of obtaining polypropylene is a set of measures aimed at ensuring high quality and sustainability of the production process. Implementing the right management strategy will help improve production efficiency, reduce costs and improve the quality of finished products [5].

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Decision Making in Uncertain Conditions

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In the competitive manufacturing industry, it is necessary to have an action strategy that can be in the form of a decision. However, the decisions taken can still to contain risks because the results of these decisions are unknown with certainty. One of the decision-making activities in uncertain conditions is the determination of investment in a company. In this case, the investor team will be faced with 3 choices of companies in Gresik, namely PT X, PT Y, and PT Z. The methods that can be used in this case are the maximax method, maximin method, equal likelihood method, realism method, and maximax regret method. In the decision-making process, the data needed are the profits generated in the new school year and non-new school year periods. Data on the results of profits in the new school year for PT X is $ 5,300,000, for PT Y is $ 400,000, and for PT Z is $ 200,000. Whereas for the non-new school year profit for PT X is $ 100,000; PT Y and PT Z suffer losses of $ 150,000 and $ 50,000 respectively. The steps in this method are making investment decision tables, selecting alternatives, based on the method used, each method has different steps. The final step summarizes the results that have been obtained to analyze the comparison of the five decision-making methods under uncertain

conditions. So, the decision results are obtained for each method, namely the maximax method is PT Y, while the maximin, equal likelihood, realism, and minimax regret methods have the same decision, namely PT X.

Relevance Study of Engineering Drawing Course and Vocational High School Productive Subject of Engineering Drawing Major with Competency Test Standard

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Engineering drawing as part of study fields in engineering, which is learned not only by engineering vocational high school students such as engineering drawing major, but also university students especially Mechanical Engineering Education Department of FPTK UPI. However, there are not conducted a material sequence mapping of engineering drawing subject and the relevancy between engineering drawing, which is learnt in university and vocational high school. Vocational high school students have to take competency test especially in Engineering Drawing Major, in which it gives assumption that university students are expected to be able to do the same, as competence measure. Specific competency should be acquired, even though it has not been done thus far. Relevancy principle is one of the curriculum development principles, as a compass that corresponds the world development. Free Hand Sketching method is hand sketching, where a draftsman does not use additional tools. Instrumental method is a method that uses additional tools in the technical drawing process, such as rulers, drawing machines, malls and so on. Computer method is a method that uses a computer to draw techniques. This method uses CAD (Computer Aided Design) applications/software, such as: AutoCAD, Autodesk Inventor, Solidwork, CATIA etc. Today, companies, engaged in manufacturing and design are already used computer methods because they are considered more practical, fast and easy to reproduce. This study was conducted to obtain the description of the subject relevancy, and sequence mapping of the three materials of engineering drawing in the university, engineering vocational high school and competency test. The method that is used in this study is evaluation with discrepancy approach. Material relevancy between Engineering Drawing Course, the Engineering Drawing Productive Subject and competency test of engineering drawing and contents material mapping were obtained from the research which then was presented and analyzed. The course material of engineering drawing was completely supported (100 %) by the subject material of engineering drawing in vocational high school. However, the engineering drawing productive subject was not totally (85 %) supplied by the content, which is included in engineering drawing course. They both totally supply (100%) the content in engineering drawing standard competency test.

Investigating the Equivalent Properties of a Porous Piezocomposite with Metalized Pores' Boundaries Using a Random Representative Volume Considering Heterogeneous Polarization

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Using porous piezoelectric materials is an attractive prospect due to their capacity to vary their effective material coefficients by varying the porosity, which might potentially improve their efficiency in different applications such as hydrophone sensors, energy harvesting or microelectronic devices. However, piezoceramics, and thus porous piezoceramic composites, are brittle substances, which limits their practical impact. To improve the physical and functional properties of porous piezoceramic composites, Rybyanets et al. created a unique fabrication technique that combines the microstructural design approach (MSD) with the micro- or nanoparticles transport approach. In the result of this method, they generated a porous piezocomposite with metalized porosity boundaries. Here, we introduced a more realistic numerical model for getting more precise equivalent characteristics of this composite. This numerical model employs a newly constructed representative volume element (RVE) with randomly allocated spherical inclusions and considers the inhomogeneous polarization field around inclusions. The RVE, built using the algorithm proposed here, can be constructed faster than the RVE, built using the well-known random sequential adsorption (RSA) algorithm, and the finite element (FE) mesh can accommodate up to 50 % of the inclusion's volume fraction without encountering any issues. The hollow metal spherical inclusions were modeled as solid spherical inclusions, filled with mechanically weak electrically conducting material. Because of the existence of metallic inclusions within a piezoelectric matrix, an irregular polarization field is expected, particularly around the inclusions. Due to the random orientation of their microscopic domains, piezoelectric materials do not exhibit a macroscopic piezoelectric effect prior to polarization. Thus, the polarization field was obtained by solving the corresponding dielectric electrostatic problem. Later, the algorithm employed these polarization vectors, considering saturated polarization, to adjust the material properties of the piezoelectric matrix's finite elements. Due to the complexity of the microstructure, a numerical homogenization approach, based on the finite element method and the Hill-Mendel's principle, was applied. The algorithm was completely designed in ANSYS APDL, and the FE mesh was built using the SOLID227 finite element. The influence of the considering inhomogeneous polarization field on the macro properties of the ordinary porous piezocomposite/system (OPS) and the porous piezocomposite with metalized pores' surfaces (SMPS) was investigated. Both composites' equivalent elastic stiffness and dielectric permittivity properties, as well as the OPS's equivalent piezoelectric coefficients, were nearly independent of polarization field heterogeneity. The polarization field heterogeneity had a considerable impact on the SMPS's effective piezoelectric coefficients e_{31}^{eff}, e_{33}^{eff}, and d_{31}^{eff}. The results revealed that the SMPS can be used to make piezoelectric transducers with improved transverse sensing and actuation efficiency.

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Preparing and Study of the Bismuth Ferrite – Yttrium Manganese Composite

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The bismuth ferrite ($BiFeO_3$, BFO) is the classical and most studied multiferroic, which combines ferroelectric and antiferromagnetic properties at room temperature [1 – 4]. At the same time, it has very high temperatures of the antiferromagnetic (T_N = 640 K) and ferroelectric (T_C = 1100 K) transitions [5]. $BiFeO_3$ is the basis for various materials in the solid state (solid solutions, composites, thin films, heterostructures, etc.). The BFO compounds with other multiferroics, which differ from it not only in structure, but also in the nature of the manifestation of properties, are of particular interest. One of such material is, for example, yttrium manganese $YMnO_3$ (YMO). Yttrium manganese is a low temperature multiferroic (T_N ~ 80 K), which exhibits ferroelectric properties at room temperature. Moreover, it has a high-temperature antiferromagnetic transition (T_C ~ 900 K) [6, 7]. There are a number of studies of solid solutions, based on BFO-YMO system. However, in most cases, the investigations are limited to low concentrations (up to 20 %) of one of their components. This is due to the phase diagram of these materials has a rather complex composition [8]. Therefore, in order to preserve their structure and properties separately, as well as to study their mutual influence on each other, the possibility of manufacturing these multiferroics in the form of a composite with a high molar fraction of each is of great interest. The report presents the results for the composite obtaining in a molar ratio of BFO:YMO = 1:1 and the studies of its structure, microstructure, and temperature-frequency characteristics. The initial BFO and YMO have been obtained at the Research Institute of Physics of the Southern Federal University. It is shown that the method of prepare does not affect the structures of the materials that make up the composite. At the same time, the material has good characteristics of piezoelectric moduli and dielectric constant. Preliminarily, close to room temperature phase transition is observed in the composite. Processing of the dielectric spectra was carried out using a new model for describing dielectric spectra [9], which once again showed high convergence with the experimental points.

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Piezomaterials Based on Phases of the $BiFeO_3$-$BaTiO_3$ System (Low-temperature Technologies, Electrophysical Properties)

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At this stage of development of modern industry, high-temperature control of several technological processes is becoming increasingly important. One of the options for such control can be based on the use of high-temperature piezoelectric transducers, which are based on ceramic piezomaterials, based on the phases of the $BiFeO_3$ – $BaTiO_3$ system. This is due to the Curie temperature and operating temperature of these materials reaches 750 K and 560 K, respectively [1 – 3]. The disadvantages of these materials include the low reproducibility of their electrophysical parameters (EPPs), which is associated with technological disadvantages of high-temperature processes for the synthesis of powders of base phases and sintering ceramics made on their basis (removal of Bi_2O_3 from systems, as well as thermal destruction of Fe_2O_3 and $BiFeO_3$). To solve these problems, we have developed low-temperature technologies for the synthesis of ultrafine powders of several alloyed phases of the $BiFeO_3$ – $BaTiO_3$ system adjacent to its morphotropic region. Ceramic piezomaterials, based on this system, retain their sufficient piezo activity, for a long time, at temperatures up to 570 – 600 K (within the framework of stationary and variable temperature regimes of their operation). The report presents technological schemes of low-temperature synthesis of ultrafine powders (UFPs) of target phases (T = 670 – 720 K, for 30 – 40 min). The precursors of these processes are peroxide, peroxonitrite and nitrate compounds of basic elements. For manufacturing the target products, mixtures of precursors were under a mechanical treatment in the planetary mill (Pulverisette 5). An intermediate product was separated from a liquid phase, got dried at temperatures T = 370 – 390 K, and the obtained charge was pressed and calcined at a temperature regime, determined by means of the DTA and TGA methods (Diamond T6/DTA). A phase content of products of this calcination was found by means of the X-ray analysis (ARL X'TRA), and microstructure was studied by means of AFM and TEM (Solver PRO-M and JSM-6390LA). According to DTA and TGA data, processes of destruction of precursors in mixtures proceed at 350 – 630 K, and crystallization of target phases with the perovskite structure proceed at 580 – 720 K. A diameter of particles in initial powders was 55 – 85 nm. The use of UFP target phases makes it possible to produce high-quality piezoceramics from them at temperatures of 1100 – 1130 K, as well as to vary the diameter of its grains in the range from 1 – 2 to 6 – 8 nm (important factor for optimizing the domain structure of the final samples). The report discusses the EPP of manufactured PMs, their changes in the temperature range from 295 to 600 K, as well as the degree of conservation of EPP values within temperature regimes: stationary (from 1 to 24 hours at 300 °C) and variable (ten cycles from 295 to 600 K).

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Solution of the Coefficient Inverse Problem of Thermoelasticity for an Inhomogeneous Rectangle

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In various fields of technology, functionally graded materials (FGMs) are increasingly used. FGMs are inhomogeneous materials with desired properties. The FGMs manufacturing technology is multistage and requires at the last stage the diagnostics of the real properties of the product, based on the solution of coefficient inverse problems of thermoelasticity. In [1, 2], a numerical method was developed and tested for solving nonlinear inverse problems of thermoelasticity for a rod and a cylinder, based on the construction of an iterative process, at each stage of which the Fredholm integral equation of the 1st kind is solved. However, the problem of reconstructing the thermomechanical characteristics of an inhomogeneous rectangle is unexplored. The problem of vibrations of a functionally graded rectangle, the side faces of which are thermally insulated and under conditions of a sliding embedment, is considered. The lower boundary of the rectangle is rigidly clamped and maintained at zero temperature, while the upper boundary is under the action of a thermomechanical load. The direct problem after Laplace transformation is solved on the basis of joint application of the method of separation of variables and the shooting method. The transformants were inverted by expanding the original in terms of shifted Legendre polynomials. A coefficient inverse problem is formulated to determine the thermomechanical characteristics of a rectangle from additional information about temperature and displacements at the upper boundary over a certain time range. Based on the weak statement and the linearization method, operator equations in Laplace transforms are obtained for solving the inverse problem. Assuming that the additional information admits expansion in Fourier series, inverse problems have been formulated for various harmonics. After inversion for each harmonic, systems of operator equations of the 1st kind in the originals are obtained. In the case of identifying two characteristics, the kernels of the system of Fredholm integral equations of the 1st kind, due to different sensitivity in the uniform norm, can differ from each other by an order of magnitude. This circumstance leads to a strong degeneration of linear systems in the numerical implementation. Therefore, to solve the inverse problem in the originals, a step-by-step process of identifying the thermomechanical characteristics of a rectangle was used. The regularization of integral equations is based on the Tikhonov method. Computational experiments were carried out to reconstruct the power laws for changing the thermomechanical characteristics of a rectangle. It was found that monotonic functions are restored with sufficient accuracy; the reconstruction procedure is resistant to input noise.

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An Investigation into the Deceleration Effectiveness of a Large Bus Built and Operated in Vietnam

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Large buses are the main means of transport for intercity passengers in Vietnam and other countries today. Large buses have many advantages, such as transporting many passengers, saving transportation costs, reducing traffic jams, and reducing environmental pollution. However, large buses also often cause many serious accidents, one of which is due to the braking system. This report used the Newton-Euler equation system for a multibody system to study the deceleration effectiveness of large buses on six types of random routes according to ISO 8608:2016. The research shows that when the Hyundai Universe Advanced travels at a speed of 60 km/h on five types of roads (A, B, C, D, and E), the maximum deceleration effectiveness is greater than the specified value of 5 m/s^2, the shortest braking distance is less than the specified value of 36.7 m, the vehicle body rotation angle is lower than the allowable value of 8°, and the vehicle complies with the requirements of the ECE-R13 standard for brake safety. The vehicle does not meet the requirements while it is going on a class F very bad road: the maximum deceleration effectiveness is 4.4 m/s^2 and the shortest braking distance is 39.7 m, following the ECE-R13 standard, vehicles travel in an unstable manner.

AutoCAD 3D Simulation to Increase Shoe Rack Design Efficiency

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Drawing has existed since prehistoric times, and over time, drawing began to be grouped into images that could be enjoyed for their meaning, as well as images made to be visualized in real life, which later became technical drawings. To make a product or machine design, the design of the product is required. To make it easier to visualize it and so that the time needed is not too long, in drawing techniques there are two ways of drawing. First one is manually with pencil and paper, and the second digitally with software. However, now drawing manually is rarely done because it is inefficient and time-consuming. So that now more software is used because it is less time-consuming and efficient. Autocad is the software that is currently often used. One of the designs that has been made from the software is a shoe rack. Shoe racks are furniture or

storage devices specifically designed to store shoes, so that our shoes do not take up much space and can be protected from dust and maintained. In designing or depicting shoe racks in Autocad we can see how the shape, appearance, material or color of the object is appropriate in the created product. The use of materials that are planned to be used is plate iron and others. In the Autocad drawing, the material shown for the cover is dream, but actually, the material used as the closing side is not dream, but only has a gap in the iron plate. This shoe rack will later help reduce the placement of dirty shoes taking up space.

Museum Olahraga Surabaya as the National Sport Archive

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Museum Olahraga Surabaya (Surabaya Sport Museum) was established on 8 May 2021, and was inaugurated by Social Minister Tri Rismaharini and Mayor of Surabaya Eri Cahyadi. Museum Olahraga Surabaya is built to depict Indonesian histories and cultures related to the history of sport and relics from the athletes, especially Surabaya athletes. This museum is located in Jalan Indragiri No. 6, Gelora Pancasila, Surabaya. This museum stores collections from Surabaya athletes. Hundreds of collections are divided into three categories: historical collections (depicted from findings, excavation, or historical material), heraldic collections (tributes and logos), and technological collections (for things related to technology). The purpose of this research is to describe a specific place (Museum Olahraga) and to explain to the readers that Museum Olahraga Surabaya is one of the best destinations to visit. This research was conducted on Saturday, June 3, 2023, at Museum Olahraga Surabaya using a hermeneutic method, which was based on personal experiences and observation. The researcher visits the museum to interpret the experiences and put them into writing. There are some suggestions for Museum Olahraga Surabaya, namely: (i) it is necessary more attention to the feature, provided by the museum, since there are some not functional audio guides; (ii) promotion of the Museum to more audiences, with the help of the Surabaya government; (iii) protection of the items, displayed with better protectors.

Analysis of Some Applied Theories of Layered Shells on the Example of a Three-layer Spherical Shell

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The report gives an assessment of the range of applicability of applied theories of layered shells on the example of a closed three-layer spherical shell with more rigid outer layers and a light

filler (middle layer). We assume that the connection of the layers is rigid. The three most common applied theories in technical applications are taken as the object of study. The first theory is based on the Kirchhoff – Love hypotheses for the entire package as whole (the theory of a single normal). The second one is based on the adoption of the Kirchhoff – Love hypotheses for each carrier layer, and for the filler, constancy of the shear over the thickness. We will call this theory the broken element theory. The third theory generalizes the first by taking into account transverse shear deformations. The results of calculations according to these theories are compared with the exact solution of the problem and the asymptotic solution, obtained by directly integrating the equations of the linear theory of elasticity, taking into account the first two terms of their expansions in the shell thinness parameter in the characteristics of the stress-strain state. On the one hand, to elucidate the influence of the geometric and mechanical parameters of the layered shell (the first series of calculations) and on the other hand, the variability of the external load (the second series) on the accuracy of the description of the field of mechanical stresses by applied theories, two series of calculations were carried out. In the first series, the load is taken as axisymmetric in longitude, and in latitude it is determined by the Legendre polynomial of the third order, which causes its rather weak variability along the meridian. Based on the first series of calculations, the following conclusions were drawn: with an increase in the thin-wall parameter, the areas of applicability of applied theories are narrow. In general, the most accurate calculation in practically important cases is given by the asymptotic theory (with the retention of the first two terms of the expansion), as well as the theory of a single normal. At the same time, there are ranges of values for the thin-wall parameters and the ratio of the shear modulus of the middle (soft layer) to the shear modulus of identical outer rigid layers, in which, for more rigid layers, the calculation according to the theory of a broken element gives a smaller error than the calculation according to others. An analysis of the results of the second series of calculations indicates that with an increase in the load variability index (determined by the Legendre polynomial up to the tenth order), the areas of applicability of simplified theories narrow. Accounting in the constructed asymptotic solution for terms of a higher order of smallness with respect to the thin-wall parameter opens the possibility of constructing refined applied theories of layered shells.

Features of Backscattering Short Longitudinal Waves on Spatial Defects of the Canonical Form Located in Elastic Bodies

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Within the framework of the geometric theory of diffraction, based on an explicit analytical expression, the amplitude of displacements in a back-reflected high-frequency longitudinal wave from the surfaces of cavity defects in elastic bodies is studied. A detailed numerical analysis of the displacement amplitude in the case of back reflection from a cylinder, a sphere, a triaxial ellipsoid, one-sheet and two-sheet hyperboloids, elliptic and hyperbolic paraboloids is carried out for various values of the geometric parameters of the boundary surfaces. Graphs of the dependence of the displacement amplitude on the distance of the source and receiver of the

wave from the surfaces of the scatterers are plotted. The focal points of the amplitude of displacements in the reflected wave from each type of defects are established. The main methods for calculating scattered wave fields on complex-shaped obstacles in an elastic medium are based on replacing the boundary surfaces of non-planar reflectors with a set of faces of an inscribed or circumscribed polyhedron near the reflecting surface. Such an approach, of course, significantly simplifies numerical calculations within the framework of the geometric theory of diffraction (GTD). When calculating the diffraction of short waves on surfaces of a complex non-convex shape, it is necessary to take into account re-reflected waves. If the reflecting surface is replaced by a polyhedron, then the displacements in a high-frequency longitudinal elastic wave re-reflected an arbitrary finite number of times is determined by the reciprocal of the sum of the distances from the wave source to the first specular reflection point, between successive specular reflection points, from the last specular reflection point to the receiving point. At the same time, with such a replacement, firstly, the ray trajectory is distorted, and secondly, the curvature of the surfaces is not explicitly taken into account through the local parameters of the curvature of the surfaces at the points of mirror reflection. Such an approach requires justification of the correctness of replacing the surface with a polyhedron with a sufficient set of faces. To overcome these features, it is convenient to apply the physical theory of Kirchhoff's diffraction to solve this problem. The use of differential geometry methods in combination with an asymptotic estimate of Kirchhoff's diffraction integrals makes it possible to obtain explicit asymptotic expansions of displacements in scattered wave fields. The study is based on the explicit expression of displacements in a singly reflected high-frequency wave. An explicit expression for the leading term of the displacement asymptotics was obtained in the framework of GTD, based on an asymptotic estimate of the double Kirchhoff diffraction integral by the two-dimensional stationary phase method. The expression for displacements at the receiving point contains all the geometrical parameters of the problem: distances from the mirror reflection point to the source and receiver of the wave, the direction of the incident wave, and the principal surface curvatures at the mirror reflection point.

Analysis of Productivity by Objective Matrix (OMAX) Method (Case Study: PT. Moradon Berlian Sakti)

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PT. Moradon Berlian Sakti is Die Casting manufacturer of Honda motorcycle spare parts and other types of products, such as chair. Along with the rapid advancement of technology, PT. Moradon Berlian Sakti always strive to maintain and improve its existence. One of important factor that need to be noticed is the productivity issue. Productivity assessment can be conducted, based on the comparison of company input and output in terms of materials, capital, labor and energy. After learning the level or productivity index, company head can identify which condition has productivity shrinkage and take a decision increasing productivity company, based on those condition. Based on the calculations, the levels of productivity index in 2012, was virtually uniform from January to December. However, in October, the productivity was high and reached the level 94.33%. That is because that performance indicators

are in accordance with expectation of company head. While in December productivity dramatically decreased to 4.67% because of less supervision and control from the company.

The Importance of Drawing Engineering for Industrial Environment

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Drawing engineering is one of the jobs or activities of making technical drawings, in which it shows the shape and size of an object or objects that we are making with standard rules and conditions that have been set. The standard industrial techniques and conditions that we use are based on ISO standards. ISO (International Organization for Standardization) is an international institution or body for standardization. In certain countries, there are standardization bodies that are well known throughout the world, such as in Germany, namely DIN; in the Netherlands, namely NEN; in Japan, namely JIS; and in Indonesia, namely SNI. The purpose of using this technique is as documentation and storage material, as a place to convey information and technical language. The research method used is quantitative, namely data that include data collection techniques and data of processing techniques. Drawing technique is not only an image that displays the design of goods or products made but also as a technical language that communicates the design of the product to others. Therefore, technical drawing has a very important role in industry. Technical drawing also conveys certain ideas so that other people can understand concepts, based on these drawings. Standardization of images is necessary so that there are similarities, such as the use of certain symbols in images that function as information or additional information, so that parties from any country can read the images properly.

The Effect of Variations in Coconut Fiber Ash Waste as Added Material in Mortar

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Indonesia is the largest coconut fiber producing country in the world and has coconut plantation land with an area of close to 3.74 Ha. The plantation products will be used to meet human needs, while the rest of the utilization will become waste. The process of destroying waste usually takes place slowly, causing a pile of waste. Coconut fiber ash contains minerals, consisting of silica, alumina and iron oxides. This shows that coconut fiber ash has the potential for using as a construction material. The previous studies show that the use of coconut fiber ash in large quantities as a cement substitute has the potential to reduce compressive strength, so it cannot

be utilized in large quantities. In this research, coconut fiber ash will be used as an added material and not as a cement substitute in order to utilize the waste as much as possible. This study will examine the dependence of mortar characteristics on the addition of coconut fiber ash. The variation in the percentage of coconut fiber ash used is 0%, 2.5%, 5%, 7.5% and 10% to the weight of cement. The composition of mortar's mixture will be based on SNI 03-6825-2002. The studied characteristics of mortar include density (unit weight), compressive strength and absorption.

Automation Systems for Distillation Columns for Separating the Gasoline Fraction from Crude Oil

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Oil distillation technology is a process that is used to refine and fractionate crude oil. The distillation column consists of several layers of packing, each of which has a different ability to separate liquids [1]. In the normal course of the rectification process, it is necessary to maintain a constant temperature of crude oil, which is T = 180 °C. To do this, it is necessary to provide for the regulation of oil flow in the heat exchanger (heater) [2]. Crude oil consumption is not a control and regulation parameter, since the mixture enters the column directly from the pre-treatment section [3]. The temperature in the bottom tank (T = 230 °C) is controlled by the flow of natural gas into the furnace, which affects the reflux temperature and, accordingly, the temperature at the top of the column. The level of the residue in the cubic capacity of the column (L = 2.0 m) is regulated by the selection of the residue, in the tank for storing phlegm, namely by the selection of the NK-180 fraction. The product of the column is a distillate (fraction 180-VK), so it is necessary to control the composition of the distillate (Q = 5.5 %), the regulation occurs by changing the amount of reflux [4]. As part of the work of a team of authors, a distillation column automation system was designed. Also, within the framework of this work, the problem of choosing technical means for automating the technological process was solved. A feature of the choice was the presence of an aggressive environment during the course of the technological process and the need to ensure the explosion and fire safety of each device [5].

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Automation of Access Control Systems to the Building

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Various technologies and solutions can be used to automate the room access control system. One of the most common methods is the installation of contactless card readers (RFID) or biometric scanners (fingerprints, facial recognition, etc.), which allow us to determine the legitimacy of access. It is also important to install an access control system that defines access rights for each member of staff and guests. This system can either be installed on a computer or run in a cloud environment. Additional measures may include monitoring the light and temperature in the premises, setting up audio signals and visual notifications in case of unauthorized access, etc. [1]. All these technologies should be integrated into a single access control system, which can be controlled using a special application or web interface, making it possible to modify access rules and monitor events in real time [2]. Pattern recognition and neural networks can be used for access control and management systems to determine identification data by face, fingerprint or other unique features. Neural networks are trained to recognize images using a large amount of data and machine learning algorithms [3]. This technology can be useful for providing security and access control in offices, warehouses, government offices and other places, where it is necessary to restrict the access of certain persons [4]. Fingerprint recognition is one of the most common methods of biometric identification. Neural network fingerprint recognition methods can be implemented using convolutional neural networks that can extract features from a fingerprint image. These features can be used to train a machine learning model and then identify fingerprints [5].

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Automation of Accumulators Sorting for the Process of Battery Formation

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The spread of accumulator parameters in the battery can affect its overall performance and duration of operation. If the accumulators differ greatly from each other in capacity, internal resistance, voltage and other characteristics, this can lead to the following problems [1]:
(i) some accumulators may discharge faster or charge slower, which reduces the capacity of the entire battery;
(ii) if one of the accumulators has a higher internal resistance, then it can heat up and degrade faster, which shortens the life of the entire battery;
(iii) an increased voltage spread between the accumulators may lead to over-discharge of one of them, which will also reduce the overall battery capacity.
To reduce the spread of battery accumulators in the battery, it is recommended to use batteries from the same manufacturer, from the same batch and with the same capacity and other characteristics. We can also use special devices to balance the charge of each accumulator in the battery [2]. To do this, a test effect is applied to the batteries and a reaction is removed, in which its electrical characteristics corresponding to the substitution scheme are reflected [3]. Further, it is necessary to apply a decomposition modeling method to these data, that is an approach to building complex models, based on decomposing them into simpler components. To isolate the important components in the result of the decomposition of the data and then cluster them, that is use the analytical method, used to group the data, based on their similarity [4]. The data can be clustered, based on various criteria, such as the similarity of objects, the distance between them, etc. In the process of solving the recognition problem, the available information is usually divided into training, test and control samples. The training sample is used to determine the characteristics of the classifier, test and control samples are used to determine the generalizing abilities of the classifier [5].

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Automated Ammonia Synthesis System

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Ammonia is produced using the Haber-Bosch process, which was developed in the early 20th century. This process occurs in two stages and requires large amounts of energy [1]. Technologies to product ammonia according to the Haber-Bosch principle are the most common and attractive today due to their relatively high efficiency and reliability [2]. Automation makes it possible to control the ammonia synthesis process more accurately and efficiently and to avoid any possible errors that can lead to a deterioration in the quality of the manufactured product or even dangerous situations [3]. To automate the technological process of ammonia synthesis, various automatic systems are used, such as systems for controlling temperature, pressure, concentration, and others [4]. Control and regulation systems are installed on the main equipment and allow us to control all process parameters. Also, computer software is used to automate the technological process of ammonia synthesis. It allows one to control and monitor all processes in real time, as well as determine the exact values of the parameters at any given time. All this allows for more precise and efficient production control. Automation of the technological process of ammonia synthesis is an important stage in the development of modern industrial technologies and helps to significantly improve the efficiency and safety of production [5].

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Automated Information and Measurement System of Energy Resources Accounting

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The automated information and measurement system of energy accounting allows one to automatically and accurately measure and control the consumption of energy resources, such as electricity, water, gas, heat and others. It has the ability to collect, store and analyze data, and also supports interfaces for communication with other systems and devices. The system automates the accounting of energy consumption in buildings, enterprises and other places, which allows us to save resources, reduce utility bills and increase the efficiency of organizations [1]. There are several ways to build an energy accounting system, the best option depends on the needs of the organization and its capabilities. One of the ways is installation of energy consumption meters at each consumption node (for example, electricity meters on each floor of the building). This allows one to track the costs for each object [2] and to use sensors and automatic energy metering systems. It can be a heat measuring system for heating buildings, a light measuring system, a water flow measuring system, etc. Implementation of an accounting system with digital technologies for diagnostics and optimization of resource is used. These can be energy-saving management systems that analyze consumption data and allow us to make decisions about optimizing the use of energy resources [3]. The information systems for the collection and analysis of data on energy consumption help to manage energy costs, analyze costs and increase the efficiency of resource use [4]. It is an integrated system consisting of smart meters, communication networks and data management systems that provides two-way communication between utilities and customers. The system provides a set of important functions that were previously impossible or have been performed manually, such as the ability to automatically and remotely measure electricity consumption, connect and disconnect services, detect unauthorized interference, identify and isolate outages, as well as voltage monitoring [5].

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Parking Space Monitoring System Using the Radio Frequency Identification Method

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The monitoring system used in real time for parking space management services is an evolution of the traditional parking system, which not only provides users with operational information to make it easier for them to find a free parking space, but also gives operators the authority to monitor and perform simulations to illustrate a real parking system. In addition, the graphical user interface (GUI) is also integrated into the parking system to allow parking zone operators to monitor the status of parking lots and view statistics on arrival speed, service time, and so on [1]. Currently, radio frequency identification (RFID) technologies are increasingly being used together with control systems and automation of processes in transport [2]. The field of its use includes car identification systems, payment systems for transport services, as well as security and control systems [3]. An RFID tag is an electronic marker that uses wireless technology to identify and track objects. RFID tags consist of a microprocessor, an antenna, and a memory that can store unique identifiers or other information about an object [4]. RFID tags are installed on cars, and RFID reading systems are placed at certain points, such as parking lots, customs control points or parking lots. When a car with an RFID tag passes through the reading system, the system's electronics receive data about the car, such as its license plate, the time of the trip and the place, where it was registered. This data can be used to monitor speed, estimate the cost of road tax, and monitor traffic violations [5].

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Automated System for Monitoring the Parameters of Gas Pipelines

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The automated system for monitoring the parameters of gas pipelines is designed for remote monitoring and control of the condition of gas pipelines. It provides automatic registration and analysis of gas pipeline parameters, timely detection of emergency situations and operational management of gas supply facilities, depending on the information received. It consists of a subsystem for collecting and transmitting data, processing and analyzing information, as well as a subsystem for controlling the gas pipeline and contains various sensors for measuring pressure, temperature, gas flow, concentration of explosive gases and other parameters [1]. The system is based on the use of modern technologies and software solutions, which allows for high reliability and efficiency of its operation. Such a system allows one to quickly respond to possible risks and prevent emergencies in gas pipelines [2]. The main feature of the operating conditions of telemechanical systems is their territorial dispersion over a huge area along the routes of trunk pipelines. The control objects are usually located in inaccessible areas with insufficiently developed infrastructure, at a significant distance from the control points [3]. The analysis of the work demonstrated that currently the main participation of scientists is focused on the development of monitoring methods, described in many works, the development of methods for pipeline gas supply to consumers remote from the main gas pipeline, and equipment for searching for leaks of main pipelines, which is directly related to the creation of an automated system for monitoring the parameters of gas pipelines [4]. The measurement and control units of this system are based on autonomous sensor modules that receive data from flow meters, pressure and temperature sensors. The accumulated measurement data is sent to the dispatch service via the mobile Internet and is provided in the form of graphs and tables in reports available through the web interface of the information system [5].

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The Morphology of Antimony Sulfoiodide Obtained by Optimal Hydrothermal Method

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The hydrothermal method is one of the most practically significant and useful, since the variability of the synthesis conditions makes it possible to obtain different morphologies of the same substance, such as nanorods, nanowires and nanofilms. For example, SbSI rods are promising working elements for photodetectors and gas adsorption sensors, as well as for the manufacture of piezoelectric composites of any shape. The optimization of the method consisted in replacing ammonium iodide with more affordable potassium iodide. The initial reagents were placed in an autoclave, filled with hydrochloric acid. It was heated and kept for different hours. In the result of the synthesis, phases differing in purity, length and shape of particles were obtained.

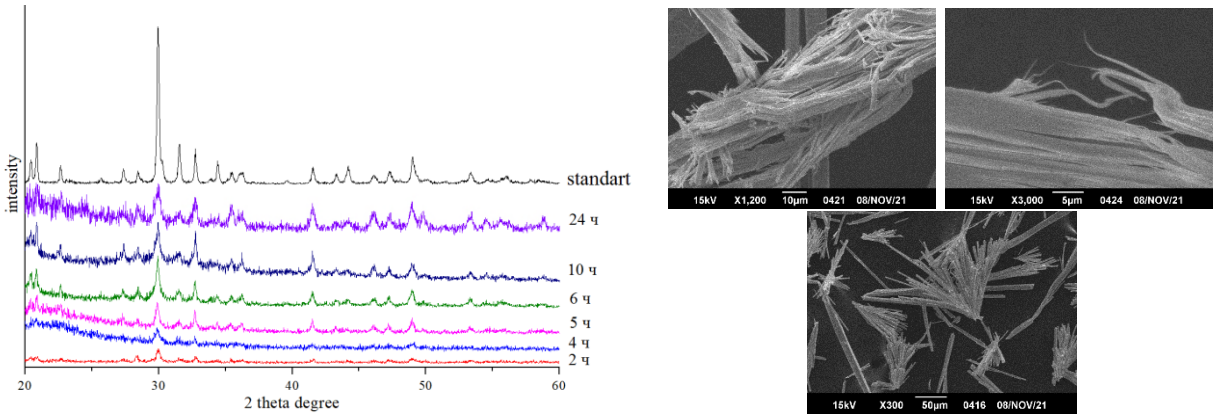

Fig. 1. Results of X-ray analysis and scanning electron microscopy (SEM)

The sample, aged for 2 hours, contained a significant amount of unreacted reaction intermediates. Samples, aged for 4 and 5 hours, had a noticeably smaller number of unreacted products. The phases obtained after 6, 10 and 24 hours of exposure had a sufficiently large yield and well-formed long rods. The results of X-ray phase analysis showed the presence of the target phase in all cases, while the longer the synthesis time, the better the crystallization of SbSI. The

results of scanning electron microscopy showed that the particles have the shape of a rod, which consisted of smaller needles, and with increasing synthesis time, their length increased. The thickness of the needles varied from one to several tens of microns (see Fig. 1).

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Piezoelectric Energy Harvesting for Last Decade

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Devices that convert the energy of the ambient environment into electricity are being developed and modernized quite intensively at the present time. The directions of the using alternative conventional energy sources are developed quite widely. The use of wind generators and solar panels are ones of the most common. The use of mechanical vibrations in the low-frequency level is possible in the practice of human use. At the same time, the main elements of the environment that have energy are wind, fluid fluxes, vibrations of structural elements and soil masses. The practical development of devices using piezoelectric elements show broad prospects for their application. The review [1] presents the latest developments in the field of piezoelectric energy collection over the past decade, largely focused on experimental, analytical and computer model solutions obtained by Russian researchers. This report presents some examples of piezoelectric devices and generators. The consideration includes medical devices, examples of piezoelectric micropumps with microneedles, models of rotary energy harvesters, calculation of the flexoelectric effect in respect to energy collection, based on experimental and analytical approaches, the results obtained for piezoelectric generators (PEGs) of cantilever and stack types are presented, some variants of piezoelectric actuators used for vibration isolation of aircraft constructions.

Acknowledgement. The study was supported by the grant of the Russian Science Foundation No. 21-19-00423, https://rscf.ru/project/21-19-00423/ at the Southern Federal University.

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Piezoresonant Response in the Region of the AFE-FE Transition of the $Pb(Zr_{1-x}Ti_x)O_3$ Solid Solutions

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Solid solutions of the $PbZr_{1-x}Ti_xO_3$ (PZT) system are the basis of many modern high-performance piezoelectric materials, which are associated with the presence in the system of two regions of coexistence of phases with different crystal lattice symmetry (morphotropic regions, MR): the first one is rhombic (R) and rhombohedral (Rh) in the range $0.040 < x \leq 0.065$, the second one is Rh and tetragonal (T) in the range $0.445 < x \leq 0.490$. This system is interesting not only from a practical, but also from a fundamental view point: (i) as a model object for studying the processes of formation and development of bulk mesoscopic crystal chemical defects (clusters) – nuclei of new phases that form in the process of approaching the MR [1]; (ii) as an object for studying various domain structures and configurations, arising as a result of a phase transition from the ferroelectric (FE) to antiferroelectric (AFE) state [2]. All this causes great interest of researchers, expressed in a large lot of scientific papers, devoted to the study of this system [3]. This work is devoted to the study of piezoresonant spectra, induced by a weak electric field, observed in ceramic samples of solid solutions of the $Pb(Zr_{1-x}Ti_x)O_3$ ($0.02 \leq x \leq 0.05$) system in the region of the FE – AFE phase transition. The results, obtained in this study, demonstrate the presence of polar piezoelectrically active clusters in the bulk of the samples, probably associated with competing domain structures, the appearance and evolution of which during the transition from the FE to the AFE phase is unambiguously reflected in the piezoresonant spectra.

Acknowledgement. The study was carried out with the financial support of the Ministry of Science and Higher Education of the Russian Federation (State task in the field of scientific activity in 2023), project No. FENW-2023-0010.

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Dielectric, Piezoelectric and Pyroelectric Properties of Ceramic Solid Solutions Based on PMN-PT and PZT

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The search for new pyroelectric materials with a set of parameters (minimum values of specific heat, relative permittivity and dielectric losses in combination with a high value of the pyroelectric coefficient) is an important task of modern physical materials science, which solution will improve the characteristics of existing pyroreceivers. In terms of the combination of parameters, the best pyroelectric materials, in most cases, are ferroelectrics, however, difficulties may arise in the way of their creation due to high technological requirements during their synthesis and sintering. A promising basis for pyroelectric materials is multicomponent solid solutions, based on the $PbZrO_3$ – $PbTiO_3$ system, including relaxor components such as $PbNb_{2/3}Zn_{1/3}O_3$ – $PbTiO_3$ and $PbNb_{2/3}Mg_{1/3}O_3$ – $PbTiO_3$. The present work is devoted to the development and study of electrophysical and, first of all, pyroelectric properties of such multicomponent solid solutions. The objects of study were ceramic solid solutions, based on the $PbTiO_3$ – $PbZrO_3$ – $PbNb_{2/3}Zn_{1/3}O_3$ – $PbNb_{2/3}Mg_{1/3}O_3$ and $PbTiO_3$ – $PbZrO_3$ – $PbW_{1/2}Cd_{1/2}O_3$ systems. The samples were obtained by two-stage solid-phase synthesis with sintering using conventional ceramic technology. The dielectric, piezoelectric, and pyroelectric properties of the obtained samples were studied in a wide temperature range. The dielectric and piezoelectric parameters were measured using an Agilent E4980A precision LCR meter. The pyroelectric response was recorded using quasi-static and dynamic methods. The results of this work can be used in the future in the development of pyroelectric detectors used for remote temperature measurement of heated bodies, including moving ones; in protection systems, which determines the relevance and significance of the results, obtained in the work.

Acknowledgement. The study was supported by a grant from the Russian Science Foundation No. 23-12-00351, https://rscf.ru/project/23-12-00351/.

Two-layer Structures Based on $BiFeO_3$ and (Sr, Ba)Nb_2O_6 Thin Films: Production Features, Structure and Physical Properties

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At present, multilayer heterostructures based on thin films of active dielectrics are intensively studied, which is due to the prospects for their application in microelectronics,

telecommunication systems, and sensors [1]. In this work, the results of studying two-layer structures, based on $BiFeO_3$ and (Sr, Ba)Nb_2O_6 heteroepitaxial films, grown on single-crystal (001) cut magnesium oxide substrates, have been presented. As can be seen from Fig. 1, the composition of the films of bismuth ferrite and barium-strontium niobate does not change over the film thickness, it corresponds to the compositions of sputtered ceramic targets, no signs of the presence of buffer layers were found. By the structural characteristics studying of each of the layers of two-layer heterostructures, it was found that, regardless of the layer deposition sequence, two types of orientational domains (± 18.4°) are formed in barium-strontium niobate. However, the $BiFeO_3$ layer is full parallel orientation with the MgO(001) substrate. It is shown that the sequence of layer deposition plays an important role in the formation of the heterostructure properties. The reasons for the revealed regularities have been discussed.

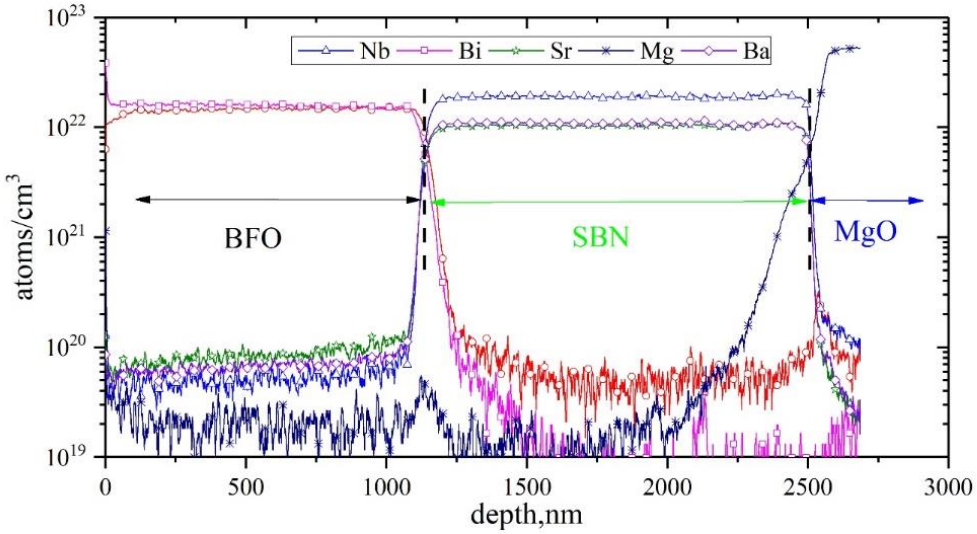

Fig. 1. Atomic thickness distribution profile of Bi, Fe, Ba, Sr, Nb, O, Mg in $BiFeO_3$/(Sr, Ba)Nb_2O_6/Mg(001) heterostructure

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Dielectric Properties of SBN-60/Si(001) at T = –190…200 °C

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The integration of ferroelectric materials into semiconductor technology is an urgent task in recent decades. This is due to the metal-ferroelectric-semiconductor and metal-ferroelectric-dielectric-semiconductor structures can be used in the development of memory elements,

pyroelectric matrices, solar cells, and various microelectromechanical systems [1]. In this work, the dielectric characteristics in the temperature range from –190 °C to 200 °C of *c*-oriented SBN-60 films with 600 nm thickness have been studied. The film was grown on a preliminarily prepared STO (10 nm)/Si (001) substrate. By X-ray diffraction, it was found that the SBN-60 films are polycrystalline and *c*-oriented. Figure 1 shows the dependences of the relative permittivity of SBN-60 on temperature at two different frequencies. Relative permittivity, calculated from the capacitance-voltage dependences of the heterostructure at a fixed temperature in the range of –190...200 °C. Here, in the SBN-60 film on Si (001) substrate, the ε values vary from 580 to 920, and the $\varepsilon(T)$ dependence has a dome shape with a maximum at T = 45 °C, due to the diffuse phase transition from paraelectric to ferroelectric phase. Burns temperature is ~ 94 °C. The reasons for the revealed regularities are discussed.

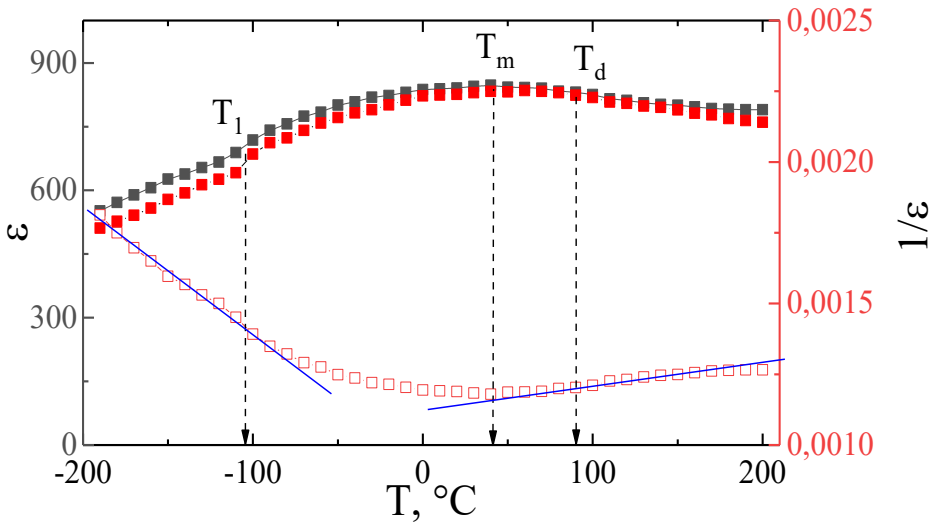

Fig. 1. $\varepsilon(T)$ and $\varepsilon^{-1}(T)$ dependencies of the SBN-60 films in temperature range of T = –190…200 °C at $f = 10^4$ and 10^5 Hz.

Acknowledgement. The work was carried out within the framework of the SSC RAS state task (project number 122020100294-9).

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Phase Diagram of a Strained Ferroelectric Nanowire

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Ferroelectric materials manifest unique dielectric, ferroelastic, and piezoelectric properties. A targeted design of ferroelectrics at the nanoscale is not only of fundamental appeal but holds the

highest potential for applications [1, 2]. Here, we have investigated the emergent topological phase states in a strained ferroelectric nanowire arising due to the electrostatic confinement of polarization and demonstrated the ways of manipulating and switching these states by the load applied to the ends of the nanowire. We consider a nanowire made of $PbTiO_3$ (PTO), taking the latter as an exemplary ferroelectric material. Using phase-field modeling and atomistic simulations, we construct the strain – temperature phase diagram of the system and reveal the three qualitatively different polar phases:
(i) the vortex state (*v*-phase) with polarization swirling around the nanowire *c*-axis; (ii) the helical state (*h*-phase), with the polarization screwing along the *c*-axis; and (iii) the uniform polarization state, extending along the *c*-axis (*c*-phase). As we demonstrated, the nanoscale confinement of a ferroelectric, forming the strained nanowire, stabilizes emerging topological states and brings functionalities that do not exist in bulk materials. Nanowires supporting vortices and helical phase are of special interest for applications since these topological excitations are well controlled and manipulated by electric fields. This may promote and trigger giant piezo- and ferroelectric responses. Remarkably, we revealed that ferroelectric topological excitations in nanowires are controllable not only by electric fields, but also are well tunable by the temperature and lattice strain.

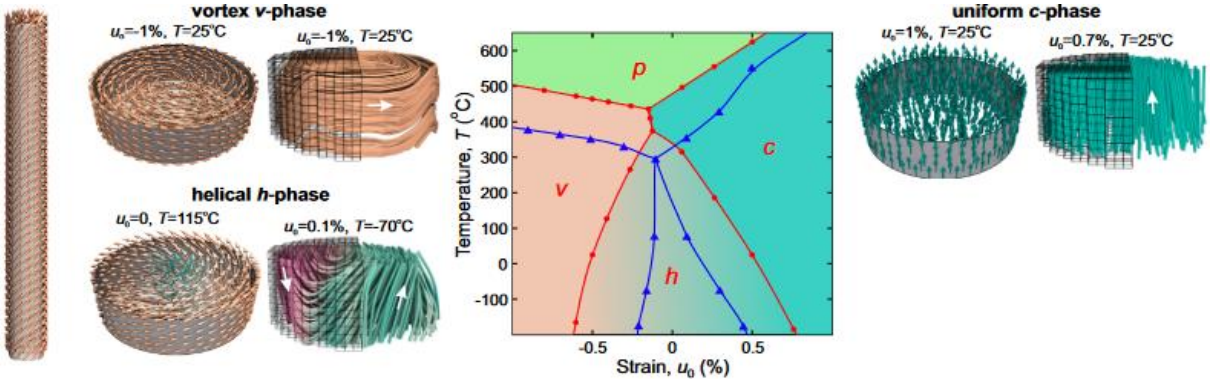

Fig. 1. Emergent phases of strained ferroelectric nanowires. In the center of the figure is the strain – temperature phase diagram, comprising the phase-field and atomistic simulations.

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Supervisory Control of Gas Supply

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Gas supply is an important infrastructure for domestic and industrial gas consumption. Gas supply includes several elements: a network of gas pipelines, gas supply stations and devices for controlling and monitoring the gas flow. Gas supply is an important and reliable source of energy, which provides convenience and cost-effectiveness for consumers [1]. Dispatch control

of gas supply is a system that ensures reliable and efficient operation of gas pipelines and gas distribution stations. Dispatch control includes the following elements: monitoring, diagnostics, control, operational support, backup power supply and communication systems [2]. The main goal of dispatching control is to ensure the safety of people and the preservation of the environment [3]. Dispatchers control the technological scheme of gas supply and track changes in pressure and gas flow in gas pipelines. In the case of detection of errors or emergencies, dispatchers immediately take measures to prevent the consequences. Dispatchers use computer systems to control gas supply. They collect information from sensors in real time and analyze it to make decisions about adjusting pressure and gas flow. An important part of the work of dispatchers is the management of backup power supply and communication systems. They monitor the state of the generators and use communication tools to communicate with other members of the service in case of an emergency [4]. The use of modern technologies and services for gas supply management increases its reliability and efficiency. The use of intelligent systems and cloud solutions makes it possible to simplify dispatching processes and improve the quality of customer service. Dispatch control of gas supply is a necessary system to ensure the safe and reliable operation of gas pipelines and gas distribution stations. Dispatchers control the operation of the entire gas supply process using computer systems and communications. Modern technologies and services help to improve this process and increase its efficiency [5].

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Approximation of the Motion of Discrete Vortices by Classical Numerical Methods in Combination with the Fast Multipole Method

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In this report, we consider the problem of motion of an ideal incompressible fluid. Equations of motion (1), (2) are presented in terms of vorticity:

$$\begin{cases} \dfrac{d\omega}{dt} = \dfrac{\partial\omega}{\partial t} + v_x \dfrac{\partial\omega}{\partial x} + v_y \dfrac{\partial\omega}{\partial y} = 0, & (1) \\ \dfrac{\partial v_x}{\partial x} + \dfrac{\partial v_y}{\partial y} = 0. & (2) \end{cases}$$

The equation system (1), (2) presents transition from a continuous model to a discrete one, where the liquid medium is represented as a system of discrete vortices. In the framework of the discrete vortex (DV) method, each material particle of a liquid is considered in Lagrange variables, while the intensity remains constant throughout the entire process of fluid motion [1]. In addition, the influence of vortices on each other is taken into account according to the Biot – Savard law [2, 3], and the components of the velocity of liquid particles are given by the Biot – Savard formula as follows:

$$\frac{dx_i}{dt} = v_{x_i} = -\frac{1}{2\pi}\sum_{j\neq i}^{N} \frac{\omega_j \left(y_i - y_j\right)}{\left(x_i - x_j\right)^2 + \left(y_i - y_j\right)^2}, \quad \frac{dy_i}{dt} = v_{y_i} = \frac{1}{2\pi}\sum_{j\neq i}^{N} \frac{\omega_j \left(x_i - x_j\right)}{\left(x_i - x_j\right)^2 + \left(y_i - y_j\right)^2}, \; i = 1,\ldots,N, \qquad (3)$$

To speed up the process of integrating equations (1), (2), a fast multipole method is used, in which (3) should be set in complex form. The contribution for each vortex *i* calculated by (4), the sum is selected depending on the location of the source-vortex *j* relative to the region, in which the receiver-vortex *i* is located:

$$S_{l,i}^0 = \frac{1}{2\pi}\sum_{\substack{\zeta_j \in G_l \\ j\neq i}} \left(\frac{\omega_j}{\zeta_i - \zeta_j}\right), \quad S_{l,i}^1 = \sum_{k=0}^{K} \frac{1}{\zeta_i^{k+1}} \sum_{|\zeta_j|<|\zeta_i|} \zeta_j^{\,k}\omega_j,$$

$$S_{l,i}^2 = \sum_{k=0}^{K} \zeta_i^k \sum_{|\zeta_j|>|\zeta_i|} \frac{\omega_j}{\zeta_j^{\,k+1}}, \quad (\zeta_i \in G_l), \quad i = 1,\ldots,N \qquad (4)$$

Thus, the computational complexity of the algorithm will decrease, compared to classical numerical methods with $O\left(N^2\right)$ before $O\left(N^2/L + K\cdot L\cdot N\right)$.

Acknowledgement

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Epidermal Sensors Produced by 3D Printing

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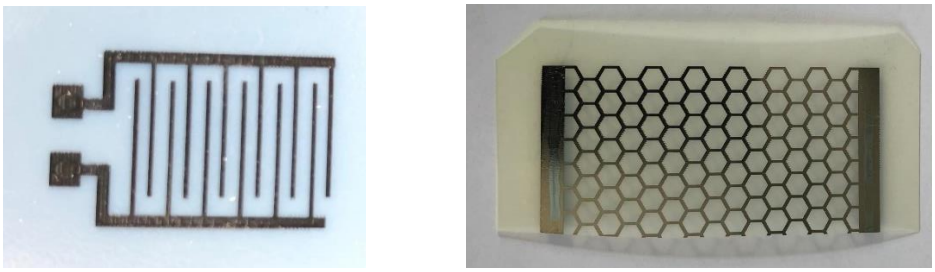
The essence of the scientific direction "epidermal electronics", proposed in the early 2010s, is to place on flexible thin elastic substrates, similar in their physicochemical and mechanical properties to the human skin epidermis, elements of sensory structures, as well as batteries, transforming, receipting and transmitting signals [1]. In this regard, at present, an urgent task in this area is the development of technological approaches for creating sensory devices on elastic substrates. One of such methods for forming sensitive elements of epidermal sensors on a flexible substrate can be 3D printing. The use of appropriate PLA plastics with conductive and/or ferroelectric properties for this purpose will allow the formation of appropriate sensitive epidermal elements. In this work, a study was made of the possibility of forming epidermal sensors for monitoring the human condition using 3D printing methods. Film sensors were printed on an FDM type 3D printer on a flexible polyvinyl fluoride substrate for the “honeycomb” type structure, and polyurethane elastomer for the comb finger structure (CFS). The material for printing, the CFS-type structure was thermoplastic polyurethane (TPU) with the addition of multi-walled carbon nanotubes, printed at 200 °C. “Honeycomb” structures were printed at 250 °C by using polyvinylidene fluoride (PVDF) filament with the addition of cobalt ferrite. Models of epidermal sensors formed on a flexible substrate by 3D printing are shown in Fig. 1. Studies using the AFM method at the Ntegra Vita probe nanolaboratory showed that the average thickness of the formed films is 622 nm for the “honeycomb” type structure and 278 nm for the CFS-type structure. In this case, the average value of the surface roughness of the films is 24.3 nm for the honeycomb-type structure and 21.9 nm for the CFS-type structure, respectively. Using the AFM method in the spreading resistance measurement mode [2], the resistivity of the materials of each of the samples was determined. The calculated values of resistivity were 618 Ω·cm for the “honeycomb” type structure and 206 Ω·cm for the CFS-type structure. The resistance of the “honeycomb” structure, measured at room temperature was 6 Ω, and the capacitance of the CFS -type structure was 1 pF. The results obtained can be used to develop and form elements of a wide family of different epidermal electronics sensors for monitoring the state of the human body.



(a) **(b)**

Fig. 1. Layouts of epidermal sensors, formed on a flexible substrate by 3D printing: (a) CFS-type structure; (b) “honeycomb” structure

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Investigation of Resistive Switching in Nitrogen-doped Carbon Nanotubes as Function of Nitrogen Concentration

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One of the promising areas in the field of creating non-volatile memory is the development of memristors that can change their resistance, depending on the flowing charge. The first memristors were implemented on metal oxides [1, 2]. However, a search is underway for alternative functional materials in order to improve the switching parameters of memristors. One such material is carbon nanotubes, which have high scalability and switching speed. Our research is aimed at developing memristors based on nitrogen-doped carbon nanotubes (N-CNTs), which demonstrate the possibility of multilevel resistive switching [3, 4]. The aim of this work is to study the effect of nitrogen concentration on the resistive switching of N-CNTs. The samples under study were arrays of N-CNTs, grown by plasma-chemical vapor deposition. The nitrogen concentration was varied by changing the ratio of ammonia (NH_3) and acetylene (C_2H_2) from 1:2 to 1:5. The thickness of the Ni catalytic layer was 15 nm. Molybdenum 100 nm thick was used as the bottom electrode. Molybdenum makes it possible to grow N-CNTs with a high concentration of dopant nitrogen. The studies were carried out by atomic force microscopy (AFM) using a probe with a conductive TiN coating. In the process of measuring the current-voltage characteristics (CVCs), the probe was grounded, and a voltage with amplitude from ±2 to ±10 V was applied to the lower electrode. In this case, N-CNTs experienced bending deformation, caused by pressing the AFM probe to the top of the nanotube. The chemical composition was analyzed by X-ray photoelectron spectroscopy (XPS). XPS spectra showed that, a nonlinear change in the concentration of the nitrogen dopant in N-CNTs from 9.8 to 12.1 % at. is observed with an increase in the ratio of C_2H_2:NH_3 flows from 1:2 to 1:5. The results of CVC measurements showed that the ratio of resistances in the high- and low-resistance states (HRS/LRS) was 4, 15, 3, and 35 at a read voltage of 1 V with the ratio of C_2H_2:NH_3 flows 1:2,

1:3, 1:4, 1:5, respectively. The maximum resistive switching was observed at the highest nitrogen concentration of 12.1 % and an aspect ratio of the length to diameter of the nanotube equal to 10.9. The minimum resistive switching was observed at a nitrogen concentration of 9.8% and an aspect ratio of 15.1. An increase in the HRS/LRS ratio with an increase in the nitrogen concentration is due to an increase in the number of bamboo-like "bridges", which are the source of piezoelectricity and the cause of resistive switching in N-CNTs [4].Thus, it has been found that the value of N-CNT resistive switching can be controlled by changing the ratio of acetylene and ammonia flows, which leads to a simultaneous change in the concentration of the dopant nitrogen and the geometrical parameters of the nanotube. The established regularity is consistent with the previously proposed mechanism of resistive switching in deformed N-CNTs and can be used in the development of multilevel switching memristors.

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Design and Analysis of Piezoaeroelastic Energy Harvester for Mid-range Wind Velocity Applications

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The use of sensors and actuators are now becoming a common practice in our day-to-day industrial practices. These sensors and actuators have proved to be vital for increasing the efficiency of various engineering applications. Initially, the amount of energy required by sensors for various purpose was being fulfilled with low energy density energy sources. However, with industrial development, a lot of inputs to sensors were increased and a continuous source of energy was required. Additionally, these sensors were placed in such a hazardous environment, where their replacement is impossible. Piezoelectric energy harvester had proved over time that they have very good potential for the replacement of energy source for these sensors. Piezoelectric energy harvester will utilize the ambient vibrations present in industrial environment for generation of electrical energy. There are various sources of this vibration, of which one is aeroelastic vibration [1]. An aeroelastic vibration can be termed as excitation received from the aeroelastic structures when, they are subjected to aerodynamic load as soon as the net damping of the system is either reduced to zero or become negative. Based on the wind speed, with which an aeroelastic structure is subjected, these aeroelastic excitations can be further classified into two categories, that is galloping and flutter [3 – 5]. These principles work in low wind speed and high wind speed range, respectively. However, the area of mid-range

wind speed based piezoaeroelastic energy harvester had not been much explored [2]. In this report, the research efforts are focused on energy generation from the mid-range wind speed, that is 4 – 7 m/s. A new geometry has been designed to harvest the energy available in this range. The proposed geometry caters the advantages of both low and high wind velocity energy harvesters and tries to eradicate the disadvantage, offered by these two harvesters in capturing the energy from mid- range wind speeds. Further, a mathematical model is prepared to show the potential of the new geometry for energy generation. For a wind speed of 6 m/s, peak voltage of 28.89 V and peak power of 8 mW are shown in Figs. 1 and 2.

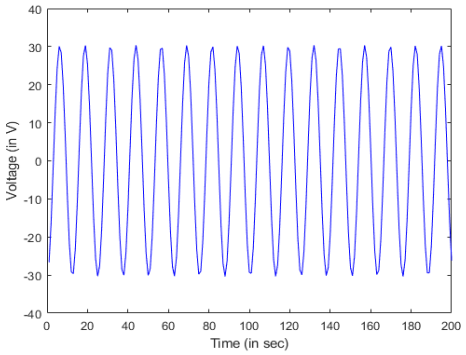

Fig. 1. Voltage to time plot

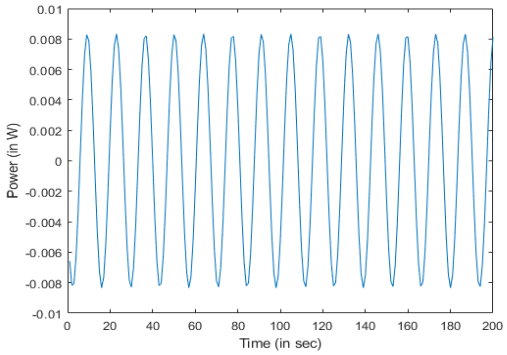

Fig. 2. Power to time plot

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Designing and Improving of Shoe Racks for Limited Space Storage Using AutoCAD Software

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At present, there are many shoe racks or footwear storage products that are generally designed to take up a lot of space and have problems, when placed in narrow rooms. The sizes also vary, which makes storage or shoe racks ineffective and inefficient, resulting in user inconvenience. Therefore, product design is needed as a facility that can adapt to these conditions. This design aims to make a shoe rack into a storage facility with a modular concept that can be adjusted so

to reduce the use of excess furniture. This design was made, using software called AutoCAD. AutoCAD itself is currently widely used in various engineering fields, including architecture, machinery, automotive, and surveying drawings. It is a software product, produced by a giant software company in the United States, namely Autodesk Inc. The result of this design is a modular system shoe rack that is easy to disassemble for needs so that it can adapt to limited space storage needs to facilitate users in terms of storage, arrangement, and retrieval so that activities can run more effectively and efficiently. This design can also be a design reference with a similar design and theme in order to increase the effectiveness and efficiency of the required space.

Automated Isopropene Mixing System

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Isopropene is a chemical compound also known as methyl vinyl ketone. It is one of the most common industrial reagents and is used in various processes [1]. In terms of chemical structure, isopropene is an organic compound with the formula C_3H_6O. It is a clear liquid with a characteristic odor and is readily soluble in water and ethyl alcohol [2]. Isopropene is used in the production of various materials such as polymers, plastics, rubbers, and synthetic textiles. Automation of the isopropene mixing process is the process of applying modern technologies to simplify and optimize the isopropene mixing process. This task can be achieved by using an automatic control system that will control the entire process from the initial preparation of materials to the final reaction [3]. Before automating the technological process of isopropene mixing, studies were carried out and the optimal mixing technology was determined. In addition, an analysis was made of the main parameters that are necessary for control at the mixing stage, such as temperature, pressure, isopropene concentration and mixing speed. The proposed automatic control system will consist of a multi-channel controller, which will be connected to a set of temperature, pressure, isopropene concentration and stirring rate sensors [4]. The controller will be programmed to automatically adjust the specified parameters. Modern technologies for automating the technological process of mixing isopropene can significantly improve the efficiency and reliability of the mixing process [5]. This approach to process control helps to reduce human error and improve work efficiency, which in turn leads to economic benefits for the enterprise.

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The Use of Artificial Intelligence in Ensuring Information Security

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Information security is a relevant and important topic for many organizations and enterprises. The complexity of the task of protecting information increases from year to year, as cyber threats become more and more cunning and sophisticated. The artificial intelligence methods used greatly facilitate the task of protecting against cyberattacks and provide more efficient and accurate detection of threats from intruders [1]. The most common application of artificial intelligence (AI) in the field of information security is threat monitoring. Many monitoring systems use machine learning algorithms and neural networks to detect threats and anomalies in the network [2]. This allows one to quickly respond to possible attacks and prevent complex cyber attacks before they cause serious damage. An equally important application of AI in information security is the prevention of cyberattacks. Such systems use machine learning algorithms to build models of attacker behavior, which makes it possible to effectively block suspicious traffic and separate it from normal traffic [3]. The use of intelligent methods to detect malicious code is also an important task in the field of information security. This area uses AI to create more accurate and diverse malware classification models and malware signature analysis [4]. Moreover, the information contained in the logs can also be used to detect threats and determine if there is suspicious activity. The use of machine learning and data analysis methods allows quick and accurate processing large volumes of logs and identify hidden threats. However, it is important to remember that AI methods are not universal solutions and require a deep understanding of the problem, as well as the expertise and assessment of information security specialists [5].

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Combination of AHP and TOPSIS Methods in Decision Support Sytems

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Various methods have been applied to decision support systems to produce alternatives that are in accordance with the criteria set by an organization or company. The various methods that have been applied certainly have advantages and disadvantages which are widely described in each study, improvements are of course always made from various studies. One of the methods often applied in the system decision support is AHP. The AHP method itself is not without drawbacks, it is not effective when used in cases with a large lot of criteria and alternatives, therefore another method is needed for combination with the AHP method in order to obtain more effective results. The combination of the AHP and TOPSIS methods was chosen on the base of that the AHP method has advantages based on the pair comparison matrix and conducting consistency analysis. Whereas the TOPSIS method can solve practical decision-making tasks because the concept is simple and easy to understand, the computation is efficient, and there is an ability to measure the relative performance of decision alternatives. The combination of the AHP and TOPSIS methods can be applied to decision support systems with various objects to be studied while still understanding the theory in the AHP and TOPSIS methods.

Productivity Analysis in Assembly Department Using Objective Matrix (OMAX) Method in Labour Intensive Manufacturing

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Productivity has become a holistic target in any manufacturing company. Performance evaluation for production areas in manufacturing should be measured by productivity index already determined in company goals and targets. Currently, the productivity index is measured

by simple calculation, which only considers production result, manpower and working hours. These calculations cannot meet management desire about real productivity itself. Management needs productivity also considering some other performance, including quality rate, rework rate, manpower, working hour, production result, energy usage, and compliance with the schedule as input data. This desire was mentioned in a company mission to be worldclass manufacturing. A well-known methods, for example objective matrix method would be used for measuring the productivity index in the company. There would be a different rank of productivity after considering all of the mentioned items when compared with the currently used method. Production could be bigger than in other month but on the other hand because of quality rate and rework, the rate was dropped. Then rank for productivity index in the considered company would be more complex and could be used as a raw model of productivity measurement internally or externally.

Productivity Index Calculation Using American Productivity Center (APC) Method at CV. Java Camera

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CV. Java Camera is a company founded in 2014 and led by Pak Husein, the owner of the rental camera. The rental camera company rents digital camera, action camera, and mirrorless camera. This rental camera company has a vision, namely, to become a rental camera company that can make customers satisfied with the goods it rent. This company also has a website to provide reviews of the rental camera they buy, and customers can provide suggestions and input data. This company wants to know its productivity index. This study was used to determine the productivity index of this rental camera company using the American Productivity Center (APC) method. From the results of the analysis using the American Productivity Center (APC) method, the results of the productivity index for each activity carried out in the company are obtained. From these results, it can be seen what factors decrease and increase a productivity. Those factors that experienced an increase were direct labor costs, direct total costs, and materials used. Those factors that experienced a decrease were labor, book value of capital, overall costs, energy used, machine maintenance costs, and travel expenses. What is subject to stipulation is the depreciation of its fixed capital.

Productivity Index Calculation Using Mundel Approach Data at PT. Maju Jaya Berkah Abadi

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PT. Maju Jaya Berkah Abadi is a company founded in 1998 and led by Pak Hendro, the owner of the furniture. The furniture company produces tables, chairs, and mattresses. This furniture

company has a vision, namely, to become a furniture company that can make customers satisfied with the goods it produces. This company also has a website to provide reviews of the furniture they buy, and customers can provide suggestions and input. This company wants to know their productivity index for their company. This study was used to determine the productivity index of this furniture company using the Mundel approach. From the results of the analysis using the Mundel approach, the results of the productivity index for each activity, carried out in the company, are obtained. From these results, it can be seen that there is a decrease in productivity and an increase in productivity determination. Those that experienced an increase were direct labour costs, direct total costs, and materials used. Those that experienced a decrease were labour, book value of capital, overall costs, energy used, machine maintenance costs, and travel expenses. What is subject to stipulation is the depreciation of its fixed capital.

Food Processing Industry Shrimp Cracker Processing in Sudi Mampir Cracker

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Sudi Mampir cracker factory is company, engaged in the industrial sector crackers, especially prawn crackers. So far, the company has experienced internal constraints meeting demand. This is due to the increasing demand from year to year, while there are limited drying areas so that production crackers are also limited. The company has plans to expand its business with the aim of meeting consumer demand. Given the investment required requires a large enough cost then a feasibility study is needed to review the feasibility of the project. Data collection comes from interviews with company owners for know the real problem and data collection through other sources such as the Central Bureau of Statistics. The feasibility study carried out includes legal aspects, technical aspects, management aspects and financial aspects. On the legal aspect, the steps will be detailed that must be taken into account and the conditions that must be observed by the company to establish company branch. On the market aspect, forecasting is carried out as a first step past requests with the regression method. Then we determine the potential market, effective potential market and effective demand. In terms of marketing and target market company, 4P (Product, Price, Promotion, Place) and STPD analysis is carried out (segmentation, positioning and differentiation). On the technical aspect, there are known machinery, equipment and supplies needed in the business expansion plan. The machines, used include meat mincer machines, milling machines, mixer machines, press machines, steamer machines, oven machines, cutting machines and plastic press machines. So, total required production floor area is 257.5 m^2 plus 1021 m^2. From management aspect, a new organizational structure is created, which is the structure functional organization. There was no change in the organizational structure, but there was additional workforce. From the financial aspect, it is known the total project cost is Rp 2,014,331,274 and includes own capital, preparation of profit and loss statements, cash flow, and balance sheet with a MARR of 20 %, an NPV calculation of Rp 3,794,915,502. Discounted payback period for 1 year 4 months 25 days, IRR is equal to 88 %, and BEP calculations are from 2009 to 2013 were amounted to Rp 1,253,566,788, Rp 1,382,393,036, Rp 1,546,723,236, Rp 1,704,556,276, Rp 1,873,603,153. From these calculations it is followed that the NPV value is positive, the DPP is less from the planning horizon and the IRR value is greater than MARR in that aspect. The project is said to be feasible

financially. After that, sensitivity analysis and ratio analysis were carried out. From the results of the feasibility of study conducted, it can be concluded that the expansion industry is carried out by the Sudi Mampir cracker factory in terms of legal aspects, market aspects, technical aspects, management aspects, and financial aspects.

Carbon Nanoparticles from Thermally Expanded Cointercalates of Graphite Nitrate with Organic Substances

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Liquid phase exfoliation of thermally expanded graphite (TEG), obtained from graphite nitrate cointercalation compounds (GNCCs) with organic substances, allows obtaining dispersions of carbon nanoparticles, namely few-layer graphene as well as small graphene structural fragments. This report presents the results of complex investigations of structural features of triple GNCC with acetic acid and acetonitrile as well as TEG on its base. Stability of the GNCC and effect of the additional cointercalant in the GNCC structure on its structural and expansion properties are discussed. GNCC was used as a source for thermally expanded graphite, which can be considered as perspective precursor for graphene and related structures. Morphology of the carbon nanoparticles, formed from corresponding TEGs by liquid phase exfoliation in tert-butanol, assisted with sonication, is discussed. The overall scheme of the GNCC obtaining involves graphite nitrate synthesis as a first stage followed by cointercalation with two organic compounds, namely acetic acid and acetonitrile (Fig. 1).

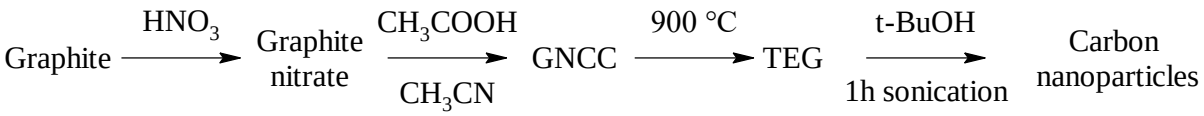

Fig. 1. Step-by-step scheme of the carbon nanoparticles obtaining

The surface morphology of the flake graphite, GNCC, and expanded graphite samples was investigated by scanning electron microscopy method. TEG samples, obtained from triple GNCCs, were used as a source of carbon nanoparticles. Destruction of the TEG cellular structure during sonication in liquid phase results in generation of single as well as few-layer graphene and related structures due to exfoliation. The microstructure of as-prepared nanoparticles,

estimated by transmission electron microscopy, and representative TEM images are shown in Fig. 2.

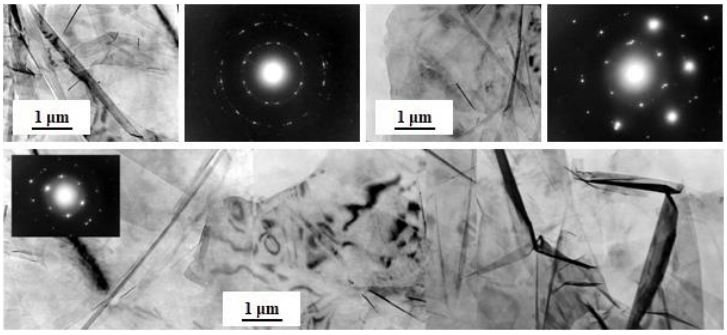

Fig. 2. Representative TEM-images along with SAED patterns of the final few-layer graphene particles, obtained from the TEG by sonication in tert-butanol

Development of Aesthetic Red Brick as an Alternative Material Based on Green Architecture

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Traditional red brick makers, are workers who handle one of the oldest types of work in Indonesia. Red brick was known since 1293 [1] and has become since the main material in construction activities. The existence of various new materials in the realm of architecture [2], as well as materials that are adaptive to the impact of climate change [3], causes a decrease in consumer interest in traditional red bricks. The impact is the reduction of traditional red brick makers due to market competition [4]. The problem of declining consumer interest in traditional red bricks has been tried to be solved by several researchers through various innovations, including Lego bricks [5] or interlock bricks. This innovation is now quite widely marketed and increases competition among traditional red brick craftsmen. So other innovations are needed which can eventually become new findings for traditional red brick craftsmen. Through this research, it is needed to find a new design of traditional red brick which besides being aesthetic also has new added value, so increasing the value and benefits of red brick as an environmentally friendly building / architectural material (Green Architecture). Architectural formations that use the new design of traditional red bricks, will become the architecture that is able to adapt the effects of climate change. With the new aesthetic red brick design, it is hoped that red brick can again compete in the market and attract the interest of stakeholders such as architects, contractors and the main thing is the project owner. In the end, the desired benefit is that it can improve the welfare of red brick makers and red brick installers.

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Productivity Calculation Analysis Using Mundel Method (Case Study: Pt. Duta Java Tea)

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Duta Java Tea Company is a company produces tea. The Duta Java Tea company calculates their production using the Mundel approach to find out if the company's production is correct or there are still many deficiencies. The Marvin E. Mundel method is one of the productivity measurement systems, monitoring productivity, namely the ratio between output with input data. Output data in the form of acceptance (revenues) while input data are in the form of production resources. Production resources can consist of work equipment, labor, energy consumption and production costs. Acceptance can be in the form of products produced. This method is used as a measurement of the company's productivity level by focusing on production costs as input data and products produced as output data. Increased productivityis done by utilizing production resources optimally. The low productivity level is caused by an increase in production costs in connection with the constraints encountered by the company such as decreased performance. The purpose of this study was to analyze the level of productivity of tea leaves, to identify the factors causing decreased productivity. In order to obtain the input and output data that causes the decrease. Data that shows such as IP Labor has increased by 4%, IP of direct labor costs has increased by 64.4%, IP of capital depreciation has increased by 90%, IP of book value of capital has decresed by 14.9%, IP of direct total cost has experienced an increase of 62.82%, IP of overall cost experienced an increase of 85.38%,fixed energy IP was 0%, material IP experienced an increase of 18.04%.

Productivity Increasing Business in Granite Tile ProductionUsing the Objective Matrix (OMAX) Method (Study Case in CV. Karya Nusa)

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CV. Karya Nusa is a company that produces tables, cabinets and chairs made of wood. CV. Karya Nusa is currently required to increase productivity. Measuring productivity is very

important because it can determine whether a company meets production productivity targets or not. Therefore, it is necessary to measure productivity to determine the value of productivity and efforts to increase productivity in the production of wooden tables at CV. Nusa works. One of the productivity measurement methods that can be used to overcome this problem is the Objective Matrix (OMAX) method. This method is used to identify factors that have a small effect on increasing productivity. The results of calculating the productivity index for each period illustrate the decrease and increase in productivity, achieved by the company. The results of calculating the Productivity Index at CV. Karya Nusa experience changes in productivity that are not stable every month. The productivity of CV. Karya Nusa experienced a decrease in November 2020 on 80.39 % and experienced a quite high increase in the following month, in December – on 594.96 %. In the following month in January 2021 CV. Karya Nusa experienced a decrease in productivity and in February 2021 it decreased on 23.73 %. Furthermore, from March to September 2021, the productivity of CV. Nusa's work was not stable, there were increases and decreases.

Measuring Productivity with the OMAX (Objective Matrix) Method: A Case Study of a Sack Production Company

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In today's advanced industrial world, companies are encouraged to improve their performance in order to have strong competitiveness. The purpose of this report is to determine the value of the productivity index in a sack company. The productivity index assessment was carried out for 15 months. Improvement was attained using the OMAX (objective matrix) method with steps: determining data criteria, performance ratios, targets, realistic productivity, weight criteria, and work achievements. The highest work achievement score occurred in the June with a value of 9.85, while the lowest productivity index value occurred in the November with a value of 0.26. The highest performance indicator was obtained in December with a value of 18.88, while the lowest performance indicator was obtained in September with a value of 0.49.

Productivity Index Calculation Using Mundel Approach Data at PT. Mebel Jaya Jaya Jaya

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PT. Mebel Jaya Jaya Jaya is a company founded in 2000 and led by Supri, the owner of the Company. The furniture company produces sofas, plastic chairs, and carved chairs. This furniture company has a vision, namely, to become a furniture company that can make customers satisfied with the goods it produces. This company also has a website to provide

reviews of the furniture they buy, and customers can provide suggestions and input data. This company wants to determine the maximum level of production profits that can get a lot of profit. So, from three products of the company (sofas, plastic chairs, and carved chairs), it is determined which of them will give the most benefit. Therefore, an analysis and survey were carried out regarding buyer interest and price of the product. After obtaining the price data and performing the survey, a decision-making and uncertainty were analyzed using the payoff Mundel method. In the result of the research, it was found that the company should produce a lot of sofas to get the maximum profit.

Tissues of Oral Cavity as Objects for Biomechanical Research: Experimental Techniques and Challenges

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The well-being of the tissues in the human oral cavity is a crucial aspect of overall health and has a significant impact on quality of life. Unfortunately, tooth decay is a widespread issue affecting billions of people worldwide. Both permanent and deciduous teeth are affected, with 530 million children of all ages diagnosed with decay [1]. Additionally, research has shown that oral tissue pathologies can contribute to respiratory and other illnesses [2]. Therefore, it is important to conduct studies on the mechanical, microgeometrical, and other characteristics of the tissue *ex vivo* as well as biocompatible artificial materials, used to treat or replace pathologically altered tissues of the tooth [3]. This work focuses on examining a range of characteristics of the sound (healthy) and pathologically altered tissues of oral cavity. These characteristics include mineralization density, reduced Young's modulus, indentation hardness, average and maximum roughness height, surface structure, molecular composition, and creep during indentation of the first visible to the dental clinician stage of caries. The study looks at both healthy enamel and dentin, as well as the same tissues in the vicinity of caries. The problems of examining tooth tissues *ex vivo*, as well as the economic feasibility of using classical filling techniques and minimally invasive methods of treatment are discussed. The information obtained is crucial for future research on minimally and non-invasive caries treatments and analyzing the strength properties and characteristics of diseased tissues. In the experimental procedure the molar was extracted from patient for orthodontic indications in the dental department of the Rostov State Medical University clinic, Rostov-on-Don, Russia. The local independent ethical committee of Rostov State Medical University approved the study (extract 15/09 dated October 3, 2019), the patient provided informed consent.

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Mechanical Behavior, Microstructure and Microgeometry of the Pathologically Altered Tooth Tissues and Dental Materials

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Early caries (white spot lesions) is characterized by the process of demineralization of tooth enamel without cavitation under a relatively intact tissue surface called pseudo-intact enamel. Micro-pores appear in the subsurface region [1]. A pseudo-intact layer is formed in the course of restoration of the mineral components of the enamel due to saliva or remineralizing solutions (containing ions intended to replace defects in the hydroxyapatite crystallites. In the present work, an *ex vivo* studies of the mechanical and microgeometrical properties as well as the microstructure of restorative fillings made of the composite material (Estelite Flow Quick, Tokuyama dental, Japan) and the glass ionomer cement (Vitremer, 3M ESPE, USA), the enamel surrounding these fillings, dentine in their vicinity, as well as sound dentine and enamel on the opposite medial side of the tooth are carried out to evaluate the efficacy of the application of dental materials. According to a similar scheme, a study was made of the mechanical and microgeometrical properties of enamel modified, using the infiltration technique (Icon, DMG Chemisch-Pharmazeutische, Germany) and dentine in its vicinity, as well as sound dentine and enamel. Nanoindentation was used to determine the mechanical properties of fillings and tissues, and atomic force microscopy was used to calculate the microgeometrical characteristics. An overview of tooth crowns after sample preparation, marking areas of interest, as well as each measurement of mechanical properties was accompanied by images from an optical and scanning electron microscopes. Composite fillings have been shown to be superior to glass ionomer ones due to greater similarity in mechanical properties to the sound enamel, less likeliness to lose adhesion at the filling-enamel interface, and fewer internal structure artifacts. The ability of glass ionomer cement to induce polymerization stresses in dentine adjacent to the filling has been demonstrated. Carious enamel treated with polymer infiltrant turned out to be generally close to it both in terms of the mechanical and microgeometrical characteristics, which indicates a high potential for the use of this technique in dental practice. In the experimental procedure the four human molars were extracted from patients for orthodontic indications in the dental department of the Rostov State Medical University clinic, Rostov-on-Don, Russia. The local independent ethical committee of Rostov State Medical University approved this study (extract 14/21 dated September 23, 2021), the patients provided informed consent.

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Investigation of the Properties of TiO_2 and ZnO Thin Films Deposited by Radio-frequency Magnetron Sputtering

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Currently, much attention is paid to the study of the properties of thin films of oxide semiconductors, such as TiO_2 and ZnO, for use in solar cells and memristors, since they have a wide bandgap and are chemically stable. Many different methods are used to form TiO_2 and ZnO films, including, magnetron sputtering [1, 2]. The problem of controlling the electrophysical and structural properties of films during magnetron sputtering is still relevant due to the large number of deposition parameters that affect it, in particular, sputtering power, inert (reactive) gas pressure, and substrate temperature. In recent years, there has been a significant increase in interest in low-temperature sputtering of ceramic targets in an inert gas atmosphere to reduce the thermal effect and oxidation of layers on the substrate surface.

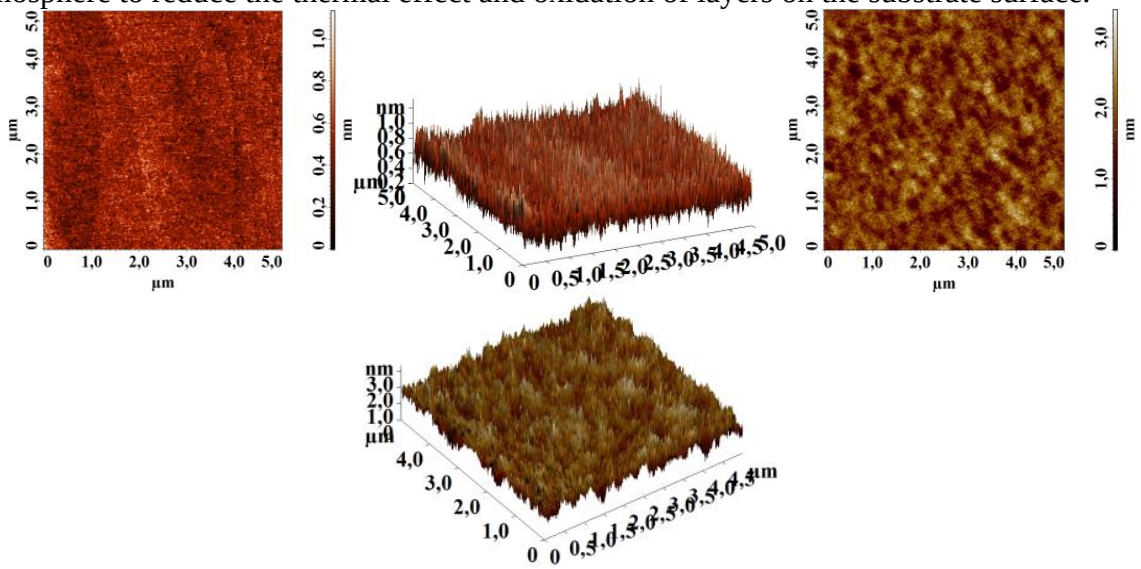

Fig. 1. AFM images of TiO_2 and ZnO films surface, obtained at a sputtering power of 100 W.

In this work, thin films of TiO_2 and ZnO were deposited on glass substrates by radiofrequency (RF) magnetron sputtering at room temperature in an oxygen-free environment using VSE-PVD-DESK-PRO equipment (AkademVak). The influence of the power of magnetron sputtering (25 – 100 W) on the growth rate and surface morphology of films for use as functional layers in the structures of solar cells and memristors has been studied. The film thickness was measured using an Alpha-Step D-100 (KLA-Tencor) profilometer, and the surface morphology was studied by atomic force microscopy (AFM) at the NTEGRA nanolaboratory (NT-MDT). Analysis of the AFM images (see Fig. 1) showed that the TiO_2 and ZnO films, obtained at room temperature in an oxygen-free medium, have an amorphous structure. All films have a smooth surface with an average roughness of 0.6 – 0.8 nm (TiO_2) and 0.9 – 2.8 nm (ZnO). In this case, the surface roughness of the films increases with an increase in the RF power of magnetron sputtering, which is associated with an increase in the kinetic energy of the deposited atoms and the thickness of the growing film. It is found that the film growth rate depends linearly on the power of magnetron sputtering. With an increase in power, the deposition rate of TiO_2 increases

from 0.4 nm/min to 2.8 nm/min, and for ZnO from 3.7 nm/min to 15.5 nm/min. This is due to an increase in the kinetic energy of the argon ions, bombarding the target, and, as consequence, an increase in the number of ejected atoms from the target, their transition to the gas phase (sputtering) and deposition on the substrate. The results obtained can be used in the formation of structures of solar cells and memristors on various substrates, including flexible ones.

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Productivity Measurement Using the Marvin E. Mundel Method: A Case Study in the Flour Company

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The development of the manufacturing industry requires business actors to continue increasing the competitiveness of the products they produce. A company can compete with other companies by measured level of productivity of the company. Measuring productivity can pay attention to the resources used so that efficiency and effectiveness can be achieved. Every company needs to take into account its level of productivity so that it can still compete with other companies. One such company is a flour company. This company in the previous few years only conducted external and internal audits to see the level of company productivity. In this case, to measure the productivity level of the company, the method used is Marvin E. Mundel. This method focuses on costs with the input of material costs, labor, capital depreciation, direct labor, book value of capital, direct total costs, overall total costs, energy consumption, maintenance, absenteeism levels and income results as output with the measuring period from January 2023 to February 2023. So that the results of the flour company productivity index are obtained, namely, the labor productivity index has decreased by 25.9 %, direct labor costs have increased by 16.3 %, capital depreciation has increased by 15.5 %, the book value of capital has decreased by 32.4 %, direct total costs increased by 68.3 %, overall total costs increased by 0.9 %, energy consumption increased by 4.6 %, materials decreased by 9.7 %, maintenance decreased by 7.69 %, the absentee level was fixed.

Productivity Measurement with the OMAX Method: A Case Study in the Flour Company

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A company can compete with other companies as measured by the level of productivity of the company. Measuring productivity can show the results of measuring a performance by taking into account the resources used so that efficiency and effectiveness can be achieved. Every company needs to pay attention to the level of productivity in order to remain competitive with other companies. One such company is a flour company. In this case, the OMAX method is used to measure the productivity level of the company. The Objective Matrix (OMAX) is a performance measurement method that evaluates several productivity criteria with weights to obtain an overall productivity index. This method focuses on the comparison between output and input. The results of the flour company's OMAX calculations showed that there was a decline in performance but then it increased again, namely March – April, May – June, August – September, November – December and February - March. Thus the Productivity Index was 2.83 in April, 0.86 in June, 0.50 in September, 18.89 in December and 8.74 in March.

Productivity Increasing Business in Door Manufacture Using the Objective Matrix (OMAX) Method (Study Case in PT. Sarana Kreasi Lestari)

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PT. Sarana Kreasi Lestari is one of the companies that produce timber doors, windows and related millwork, specialised in tropical beachfront. It provides design, manufacturing and installation of doors and window, in particular on Caribbean and Pacific islands. The production process locates in Pasuruan East Java Indonesia. Measuring productivity is very important because it can determine whether the company meets the productivity target for production or not. Therefore, it is necessary to measure productivity to determine its value and efforts to increase productivity in the production of door manufacture in PT. Sarana Kreasi Lestari. One of the productivity measurement methods that can be used to solve this problem is the Objective Matrix (OMAX) method. This method is used to identify the factors that have an influence and those that have little effect on increasing productivity. The results of calculating the productivity index for each period illustrate the decrease and increase in productivity, achieved by the company. The results of calculating the Productivity Index at PT. Sarana Kreasi Lestari experience unstable productivity changes every month. The productivity of PT. Sarana Kreasi Lestari experienced a decrease in January 2022 of 29.79 % and experienced a significant increase (102.6 %) in the following month, namely February. Furthermore, productivity from March to April 2023 productivity of PT. Sarana Kreasi Lestari was not stable with some increase and decrease.

Standard Working Time Analysis of the Production Section at CV. Wana Indo Raya Lumajang Indonesia

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CV. Wana Indo Raya is a furniture industry that processes wood raw materials into Barecore, Blackboard and Plywood products. The problem that occurs in the furniture industry is the inability to achieve production targets which often occurs because companies do not have standard working hours. Work evaluation in determining standard output is difficult to do at every work station. The research method was carried out by measuring working time directly 10 times for each work element at each work station. Production activities have 4 workstations, namely: rotary workstation, spindles workstation, hot press workstation, and sort workstation. Each workstation is measured at 5 measurement points which are places, where workers carry out work activities. Measurement of working time was carried out using the stop watch time study method with the repetitive record recording method. The results of the analysis of work start time measurements at each workstation are: rotary workstation = 0.74 min/Log, spindles workstation = 1.93 min/Log, hot press workstation = 3.33 min/press, and sort workstation = 2.08 min/sheet. The results of data analysis are used to determine the standard work time at each workstation.

Productivity of a Performance Using the OMAX Method

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PT. XYZ is a company that produces various processed flour products in the form of white bread and sweet bread and went in for business for 10 years. So far, the company has never known the productivity achieved because it has not carried out a productivity analysis on several of its resources. The intended productivity analysis is expected to show the results of a performance measurement by taking into account the resources used. Therefore, it is necessary to do a measurement or analysis of productivity in the company. An appropriate method that can be used in conducting productivity analysis is the Objective Matrix (OMAX) method. The OMAX method is a partial productivity analysis, developed to monitor productivity in each part of the company with productivity criteria, that are in accordance with the existence of that part. The OMAX method measures productivity by objectively assessing the performance of each part of the company as well as looking for factors, causing decreased productivity, if they are found. This study aims to analyze the level of productivity and provide input for productivity improvements for PT. XYZ. The advantage of measuring productivity using the OMAX method is that management can easily determine what criteria will be used as a measure of productivity so that management can find out the productivity of the organization unit for which it is

responsible, based on the weights and scores for each criterion. Weighting is done using the pairwise comparison method to prioritize each element by comparing criteria. By conducting this research, it has been found that productivity at PT. XYZ experienced up and down by looking at the performance index from January to February, which increased by 0.31; from April to May performance index was 0.29; from June to July performance index was 2.56; and from September to October performance index was 0.12.

Using the Marvin E. Mundel Method to Determine Productivity Level

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A company, engaged in the production of food in the form of fruit chips, located in the city of Malang, has problems with supporting the production process. The problem faced is the measurement of productivity that is there is not balance in the next few years. In this case, the values of output and input make costs, which are not in accordance with operational cost provisions. The low productivity level is caused by an increase in production costs due to problems with the constraints encountered by the company. Therefore, companies need to measure productivity. The Marvin E. Mundel method is used as a productivity measurement method by focusing on production costs as input (machine depreciation costs, materials used, labor, machine maintenance, energy, and utilities) and sale results as output. With these problems, it is expected to be possible to calculate the total productivity of each measurement period. After that, compare the calculation of the partial productivity index by comparing the index value of one of the inputs to the output produced by the company. From the productivity measurement, the highest partial productivity index results were achieved by 65.89 % for capital depreciation, 39.78 % for labor, 35.49 % for book value of capital, 9.48 % for labor costs, and 6.82 % for materials.

A Study of Cobalt Atom Interaction with Single Walled Carbon Nanotube (8, 0): Using Density Function Theory

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Interaction between transition metal atom Cobalt (Co) and Carbon Nanotube (CNT) (8, 0) was studied using density function theory (DFT). The atom was found to have an enhanced

interaction with the carbon nanotubes, transforming from semiconducting to a conducting tube. To predict interaction, we studied geometrical stability and deformation at the site of interaction by finding change in bond length, bond angle and binding distance. We have also found electronic properties such as band structure (BS), density of state (DOS), energy gap (EG), binding energy (BE) and charge transfer (CT). After performing geometry optimization Co-adatom attached to carbon atom of nanotube by forming covalent bond of a bond length of 1.942 Å. To find adsorption nature we found HOMO (–3.586 eV) and LUMO (3.492 eV), the binding energy (BE = –2.82 eV), chemical potential (μ = –3.539 eV) and electrophilicity (ω = –3.539) and observed that cobalt atom was electrophilic in nature strongly bound with carbon atom of CNT. The energy band gap (EG = 0.051 eV) and charge transfer (CT = 0.341 eV) showed that semiconducting CNT was turned into conducting.

Optimization of Iron Production Planning at Pande Besi Using the Goal Programming Method

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Production planning is a strategy used in the decision-making process. In this research, we visited a Pande Besi MSME that processes iron into betel, pleser, and kubut products. So far, Blacksmith's decision-making is still based on incoming consumer demand, so the production process is still not optimal because there are still many resources that can be maximized. Therefore, this study aims to apply the goal programming model in making production plans that can maximize existing resources in the company so that to obtain maximum profits. Goal Programming is a method that can solve the problem of determining the optimal amount of production. This method is the development of linear programming. This method is used to optimize limited resources with multiple targets (multi-objectives) that the Pande Besi company wants to achieve. Optimal results are carried out with Lingo software. The goal programming model has three main components, namely decision variables, target constraints and objective functions. The results of calculations using Lingo get information that Pande Besi can get an optimal income of IDR 562,000 by increasing the product capacity by 14 units of each product.

Shipping Cost Effectiveness for Wood Pallet Companies Using Transportation Methods

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Transportation problems related to the distribution of goods and services from various production centres to several sales locations Distribution plays an important role because,

without the right distribution pattern, the distribution process can be expensive and take a relatively long time. One of the linear program solutions in the distribution of goods is to use the transportation method so that the distribution of goods is as effective as possible with a minimum allocation of costs. This study describes the method of transportation for managing and distributing resources to provide products to places where they are needed to achieve transportation cost efficiency. The purpose of this research is to get more optimal results as an initial consideration to increase distribution cost savings at wood pallet companies. The data are then formulated using LINGO software, and the result is Rp. 455,620,000.

Comparative Strength Analysis and Mechanics of Basalt/Carbon Hybrid Laminates with Hole Arrangements

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We can have various combinations of composites to achieve the required mechanical properties. The use of composites in aero components has increased tremendously in the recent past due to the huge advantages offered by them. There is an abundant need of strong and lightweight material combinations to fabricate aircraft panels. Further, in structural assemblies, fastening two components by bolting or riveting is quite common. Similarly, in aero panels, bolting or riveting is practiced for joining structural components. Thus, multiple holes in different patterns are done on laminates for joining purposes. These holes in turn cause high stress concentration gradients at the vicinity of their edges. The hole edges interact with themselves or with the laminate's edges, to further increasing the stress gradient at their vicinity. It is also to note that holes' arrangements are present in different orientation and diameters (see, Fig. 1). Hence, the present study focusses on combinations of composite laminates with hole arrangements and its comparative strength analysis. Mainly, basalt composites are suitable, functional, and favourable alternative for carbon composites. The main objective of this work was set to study the influence of holes and hole-hole distances on material strength.

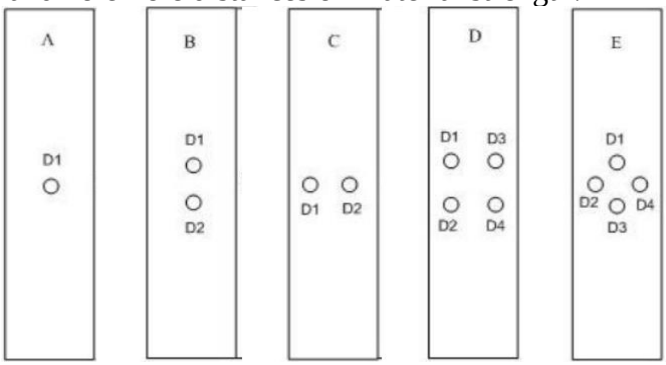

Fig. 1. Dan Jumbo's test specimens

Experimental and numerical analysis were used in this study to analyse the mechanical properties of basalt and carbon composites. For experimental part, tensile and buckling tests were carried out and further used to validate the numerical analysis. Hand lay-up fabrication was used to fabricate basalt/carbon epoxy laminates. Basalt fabric was stacked with carbon at different fibre orientation of [0º/45º/–45º] and testing was done. On the other hand, number of holes and holes' orientation on the specimens were varied to study the influence of holes on material strength. The ASTM test standard deployed were D5766 for tensile tests and STP18273S for buckling testing. For numerical part of the study, ANSYS software was used to simulate the tensile tests, which will enable the study of stress concentration around the holes. Similar testing standard was used for tensile test simulation. From this study, basalt epoxy laminates show a significant drop in mechanical strength with an increase in number of holes. In terms of hole-hole distances, the mechanical strength improves as the hole-hole distances increase. This study concludes that the closer the holes to each other, the higher the stress concentration around the hole, hence reducing the mechanical strength.

Risk Management in Project Construction

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A construction project is a series of activities related to the construction of a building, each of which can pose various risks. Therefore, with the existence of a risk management system, the flow of risk management will be known. Risk is a danger, a consequence of the consequences that may arise as a result of an ongoing process or an upcoming event. Risk is a variation that may occur naturally or the possibility of its occurrence beyond what is expected. Risk management is an approach or attempt to manage the potential hazards carried out against the risk by understanding, identifying, analyzing, controlling, and evaluating risks on a construction project. The aim of this study is to learn a risk management on construction projects. The method used is the study of the literature on risk management in construction projects, referring to the relevant theories. By identifying risks that occur, evaluating the impact of the project (risk assessment), obtaining the impact, allocating the risks that occur, then reducing the risk, and finally re-evaluating the risk after some time, The results of the studies obtained show that risk management is very important for every construction project to avoid losses on cost, quality, and schedule of completion. By carrying out the handling measures taken against possible risks (risk response) in the manner of: withholding risks, reducing risks, displacing risks, and avoiding risks.

Productivity Analysis of the Production Division at PT. Jaya Tech Palmindo Using the Objective Matrix (OMAX) Method

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PT. Jaya Tech Palmindo is a manufacturing industry company that is engaged in the manufacture and repair of production machines in palm oil mills (POM). This company is considered very helpful in terms of meeting the need for production machines, used in the palm oil industry. In this company, productivity measurement has never been carried out so that it does not know the picture of the state of the company's productivity. This productivity analysis needs to be done to determine the state of the company's productivity. The method applied in this research is the objective matrix (OMAX). The objective matrix is one of the most commonly used productivity measurement models. The OMAX method is a method of measuring productivity that is carried out quantitatively and objectively. Basically, the OMAX concept combines some of the work group's performance criteria into a productivity measurement matrix. Based on the results of the study, the company's productivity level was very volatile, the increase of 1.546 occurred in September, of 0.427 in March, of 0.202 in December, of 0.136 in April, of 0.041 in May, then there was a decrease in the performance index of 0.25 in February, of 0.224 in January, of 0.203 in October, of 0.182 in November, of 0.171 in August, of 0.041 in July, of 0.039 in June. So it can be concluded that there is still a level of productivity that is below the standard, the company needs to take measurements once a year so that it can be used as an evaluation material in the production division.

Productivity Analysis Using Marvin E. Mundel Method (Study Case in PT. Multi Kusuma Cemerlang)

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PT Multi Kusuma Cemerlang is a company, engaged in the processing of raw rubber into semi-finished materials namely Standard Indonesian Rubber (SIR) 20 and SIR 10. PT Multi Kusuma Cemerlang was established in August 2017 on Jl. Trikora, Palaran, East Kalimantan. The existence of the PT encourages the utilization of regional potential in the form of rubber available in the East Kalimantan region. P. Multi Kusuma Cemerlang (MKC) has been operating since August 2017 and is the locus of production and sales of crumb rubber types of SIR 20 and SIR 10, which produce types of natural rubber (TSR). The capacity of PT Multi Kusuma Cemerlang (MKC) is based on APKINDO of 54,000 ton/year. So, PT.MKC only produces rubber into semi-finished goods, which will later be exported as raw materials for other factories. To produce this production value, PT Multi Kusuma must estimate several factors such as labor,

materials, capital, energy consumption and other costs. After all the factors are met then output and input data gotten every year such as base period data and measured period data. After getting the data, the partial productivity is calculated. After calculating the productivity index, it will be estimated which input productivity index increases and decreases every year.

Nonlinear Optical Study with Gaussian Pulse and Flat-top Shapes of Single-walled Carbon Nanotubes with Cyclotriphosphazene-substituted Phthalocyanines Composites

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The effect of Gaussian laser pulses and flat-top pulses on the value of the transmitted energy fluence in experiments on optical limiting carried out by the method of a fixed absorber arrangement has been evaluated. The description of the nonlinear change in the transmitted energy fluence was carried out using the radiative transfer equation for the case of a threshold dependence of the absorption coefficient on intensity. The determination of the nonlinear absorption coefficient and the threshold intensity was performed on the optical limiting measurement data for a flat-topped beam. Knowing these parameters, the attenuation of the flat-top laser beam and the Gaussian beam were simulated by two methods: *Z*-scan with an open aperture and when the absorber was stationary at the focus of the lens. The experiments were carried out with liquid dispersion media of composites of cyclotriphosphazene-substituted phthalocyanines with single-walled carbon nanotubes at three wavelengths: 355, 532, and 1064 nm with subnanosecond pulse durations. The results obtained confirm the possibility of controlling the absorbed amount of energy, taking into account the profile of the laser beam. Previously, the possibility of using carbon nanotubes for the formation of tissue engineering structures was shown [1]. This allows to use near infrared IR radiation, which provides deep penetration into protein structures and reduces their denaturation compared to ultraviolet light. The magnetic properties and nonlinear optical response of carbon nanomaterials are controlled on the base of data on the defectiveness of the nanostructure using Raman spectroscopy. The combination of nonlinear optical and magnetic responses in the same sample of conjugated phthalocyanine is of great interest for future applications of photodynamic therapy and theranostics in general.

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Designing and Improvement of Drinking Bottles for Storing Liquids

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Plastic bottles are usually used to store liquids such as water, soft drinks, motor oil, cooking oil, milk, and ink. The size of the drink bottles themselves varies from very small sample bottles to large carboys. Today, the development of the drinking bottle industry is very rapid. This is due to several factors, including increasing public awareness of the need to switch from bottled drinking water products to drinking bottles that can be used repeatedly. The increase in competition in drinking bottles itself was accompanied by an increase in competitors and the level of competition. Manufacturers of drinking bottle products will continue an innovation. In producing drinking bottles, there is one of the software features that supports light learning that is effective and efficient using Autodesk Inventor. Autodesk Inventor is software designed to support product design, documentation, and stimulation in the technical and manufacturing fields. This program is often used by industry experts to design complex products and systems. That way, designing a 3D drink bottle design with software is the right modelling tool. Autodesk Inventor Professional is an engineering software product from Autodesk Corp. that is used for engineering design and drawing purposes. That way, Autodesk Inventor has advantages such as design capabilities in solid model editing (parametric solid modelling) so that engineers can modify designs without having to re-design, the ability to animate assembly files, and the ability to automatically create technical 2D drawings so that the material provided gives the appearance of a part more real.

Methods of Manufacturing Photocatalytically Active Cement-Based Building Materials

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Currently, concrete is the most common building material. In this regard, a very relevant direction of further development is the creation of cement composites with new properties. One of the possible options is the introduction of photocatalytically active additive of titanium dioxide in the anatase phase, processed to the size of nanoparticles, into the composition of

concrete considered in the work. Titanium dioxide (TiO_2) is a chemical compound of oxygen and titanium belonging to the oxides of transition metals. The appearance of the material is a white shiny powder, color stable and capable of diffusing light. The peculiarity of the additive is that TiO_2 can decompose hazardous substances into harmless ones, that is it has the property of photocatalysis. This property is enhanced under the influence of ultraviolet radiation from the sun, which contributes to oxidative processes [1, 2]. Among the advantages of using the TiO_2 photocatalyst, especially relevant in conditions of highly polluted urban infrastructure, are:
(i) the ability to preserve for a long time the original color of structures, that is their aesthetic appeal;
(ii) resistance to destruction under the influence of environment;
(iii) prevention of reproduction of microorganisms, reducing the content of harmful substances in the air up to 70 %.
Three main ways of obtaining photocatalytically active self-cleaning materials based on cement are proposed in [3]:
(i) applying coatings containing photocatalyst to the surface of finished concrete products;
(ii) introduction of the photocatalyst into the volume of concrete products directly in the production process;
(iii) creation of two-layer concrete products consisting of the main layer and the surface layer with photocatalyst.
Each of these methods has its own technological features of production and, accordingly, the advantages and disadvantages. Currently, research is underway to refine the most effective method of manufacturing photocatalytically active building materials, based on cement, both in terms of technological features and properties of the products obtained.

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Problems in Carrying out Construction-Technical Expertise

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The construction industry in Russia has a positive development trend for many years. The volume of construction is increasing, the fleet of equipment is developing, construction methods are improving, processes are digitalizing, some changes are being made in the legislative sphere of construction expertise. However, against the background of the development of the

construction industry, the number of offenses occurring between construction participants, which include manufacturers and suppliers of building materials, construction and insurance companies, banks, investors, shareholders, etc. is also growing [1, 2]. Such a diverse composition of persons involved leads to conflicts, which can be resolved in court. This procedure involves a third party, namely an expert organization (expert). In this connection sometimes expert organizations, which include low-qualified specialists, began to appear, because these organizations are not subject to licensing at present. When conducting a forensic construction-technical examination there is a need for scientific research, which must be performed by an experienced and qualified specialist. On the base of the conducted examinations of the construction object, the expert issues an opinion on the questions posed to him by the court. This report analyzes and systematizes the main problems that arise during the examination. Among the emerging problems we can highlight the problems, associated with the need for quantitative measurements [3]. For example, there are still no precise definitions of the terms "hidden" and "obvious" defects in building structures, as well as the methods of their identification during the examination. In determining the strength of masonry there is still no standardized method of assessing the strength properties by nondestructive testing methods. In laboratory tests of ceramic bricks for axial compression different methods of alignment of the brick surface are used, which can give different results [4]. Solution of these problems, would improve the system of quality of expert studies, establish specific requirements for individuals to work in forensic activities as experts. Adjustment of the regulatory framework will allow one to simplify and rationalize the activities of experts in carrying out construction and technical expertise.

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Development of a Comprehensive Methodology for Evaluating the Photocatalytic Activity of Building Materials

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The relevance of the work is due to the deterioration of the ecological state of cities, atmospheric pollution, especially in large settlements. One of the new directions to stabilize the ecological

situation is the innovative creation of building materials with photocatalytic effect. However, the development and effective introduction into the construction practice of such materials faces a number of problems. These problems are associated with an insufficient level of study of such materials. The state standard "Photocatalytically Active Self-Cleaning Concretes" is currently in force on the territory of the Russian Federation. It describes the method of assessing the photocatalytic activity of concrete. This method proposes to determine:
(i) the effectiveness of photocatalytic concretes in the decomposition reactions of nitrogen oxides and volatile organic substances;
(ii) self-cleaning ability.
Nevertheless, in spite of the comprehensive approach to the evaluation of photocatalytic properties of concretes, this methodology has a number of drawbacks. One of the main disadvantages is the high cost of the equipment, required for testing. As an alternative methodology, modern researchers suggest [1] to use the Italian standard UNI 11259-2016. This technique has a number of advantages, the main of which is lower cost of tests. At the same time, it does not allow a comprehensive assessment of the effectiveness of air purification from external pollutants. This report presents the authors' developed comprehensive methodology for evaluating the photocatalytic activity of concretes. In the tests of building materials according to this methodology a two-stage test of photocatalytic properties is proposed. The first step is the evaluation of the photocatalytic activity by the calorimetric method. The test is performed under normal atmospheric conditions in a dark wooden box. An organic dye is applied to the surface of the test sample and then the sample is exposed to ultraviolet radiation. The calorimetric change over time is evaluated. The second stage of the photocatalytic properties test is to evaluate the change in air pollution. The sample is placed in a closed vacuum container and again exposed to ultraviolet radiation. It is proposed to evaluate the test results using statistical methods of control [2], which will allow us to speak in full about the reliability of the tests.

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On the Adulteration, Counterfeiting and Forgery of Building Materials

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The fight against illegal and counterfeit products today is one of the most acute problems not only in Russia, but probably all over the world. The list of counterfeit products affects a wide range of products: food, medicines, spare parts for machinery and equipment, children's goods

and the like. The construction industry is no exception to this list. At least 7 % of the world's production of construction materials is counterfeit. In Russia, the turnover of low-quality and counterfeit construction materials in some market segments reaches 50 – 60 %. The most well-known brands and products are subject to counterfeiting [1, 2]. This paper analyzes and systematizes information on counterfeiting, adulteration and forgery of building materials and products on the Russian market [3]. It is shown that all this leads to a change in the quality characteristics of building materials. Each type of falsification is characterized by its own ways of counterfeiting. The acquisition of low-quality building materials is facilitated by various types of counterfeit goods:

(i) phonetic imitation, when there is a phonetic mixing of associative rows due to copying of verbal and sound elements of the brand; For example, “KNAUF” and “KWAUF”;

(ii) color imitation, which consists in copying external design of a brand or key elements of a trademark;

(iii) plot, when there is a borrowing of brands, which differ by their own author's way of promotion or advertising; for example, “Dulux BINDO” and “Sadolin BINDO”.

An important way of determining the adulteration of construction products is to conduct various *in situ* and laboratory experiments, including nondestructive testing methods [4]. In order to protect the consumer from substandard products, a competent approach for conducting identification, that is establishing the identity of the products with their essential features, is necessary. Correct implementation of this procedure helps to avoid counterfeiting of building materials.

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Tunjungan Street as a Tourist Destination

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Tunjungan Street is one of the famous landmarks in Surabaya. Since the Dutch colonial era this area has become one of the famous commercial areas in Surabaya, this road is used as a link that becomes the main shopping area in Surabaya. Various shopping centers, shops, restaurants and

hotels occupy along this street, besides that this street also has historical value and architectural beauty of the building, which is a silent witness to the development of the city of Surabaya, which of course must be maintained or treated properly. This research aims to improve the tourist experience of visiting tourists, by providing recommendations in managing this street into an attractive tourist attraction in a sustainable manner. In this research, we use direct observation method, conduct observations and analysis to obtain data regarding the recommendations needed to make managing this road into an attractive tourist attraction in a sustainable manner. Based on the observations that have been made, there are several aspects that need to be considered related to Tunjungan Street as a tourist attraction. These include cleanliness that needs to be improved, guiding blocks that are less friendly for people with disabilities, more efficient traffic arrangements, and the placement of security officers to increase safety fortourists. There are several suggestions to improve the tourist experience, related to cleanliness and arrangement, is the need for good hygiene management such as, placement of trash bins in several corners of the street as well as regular cleaning, besides the arrangement of guiding blocks that are friendly to people with disabilities and maintenance of attractive parks and sidewalks, can provide a more pleasant experience for visitors. Regarding more efficient traffic arrangements, it is necessary to add pelican crossing and provide adequate parking lots. This is done to make tourists feel safe and comfortable. In terms of security management, it is necessary to place enough officers or CCTV cameras in several corners of the road to make visitors avoid worry while exploring Tunjungan Street.

Mechanism and Management of Compensation Policy for Environmental Pollution from Environmental Health Legal Perspective

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Pollution not only affects people's lives today, but also threatens their survival in the future. If one of the parties who are harmed or harmed feels harmed by an activity that pollutes or damages the environment so that the occurrence of this can turn into an environmental conflict. Requirements for compensation for parties, harmed by environmental factors, were previously regulated in the elucidation of the Regulation of the State Minister for the Environment, Number 13 of 2011, but implementation was not carried out. So that every citizen or community has the right to a healthy and good environment that is bound to protect the environment and also to prevent and mitigate environmental pollution and damage, protect and manage the environment as a form of human endeavor in carrying out its interactions with the environment in order to sustain life to achieve prosperity and environmental sustainability. The criteria for compensation for victims of pollution are regulated by changes in the value of property before and after pollution and/or environmental damage, how to value community assets, how to calculate additional costs and cost prevention, loss of income, changes in operations, and money generated by pollution and/or environmental damage, as well as medical costs. If the polluter is required to include costs of pollution and/or environmental damage into the calculation of production costs, operational and/or operational costs, in addition to paying the agreed compensation, then the compensation is considered reasonable. An obstacle to paying proper compensation to victims of pollution is the lack of human resources in the area, such as experts

in calculating environmental compensation. Compensation must be carried out according to the procedures of the Environmental Agency and special laws, so that the person concerned bears legal responsibility for losses paid to victims of environmental damage. For this reason, the formulation of the problem can be found, namely what is the procedure for providing compensation for environmental pollution in the bio-industrial area.

Effect of Accelerating Voltage during Si(111) Surface Ion-beam Treatment on the Substrate Structure and GaAs Nanowire Growth Processes

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Semiconductor nanowires (NWs) have unique properties, which makes them promise for the creation of opto- and nanoelectronics devices. However, this requires the development of effective methods to control the NW characteristics, including through pre-growth surface preparation. One of these methods is the preliminary modification of the substrate using a Ga focused ion beam (FIB). The aim of this work is to study the effect of accelerating voltage during Si(111) surface ion-beam treatment on the substrate structure and the GaAs nanowire growth processes. For this purpose, 5×5 μm^2 structures were formed on the Si(111) substrate by FIB irradiating the surface with an accelerating voltage of 10 – 30 kV (with 10 kV step) and the same implantation dose of 0.3 $pC/\mu m^2$. GaAs NW growth was carried out on modified substrates after preliminary annealing in vacuum by molecular beam epitaxy at a temperature of 600 °C with a deposition rate of 0.25 ML/s for 48 min. The samples were analyzed by SEM and Raman spectroscopy. Analysis of SEM images showed a sharp increase in the NW density and GaAs parasitic phase crystallites within the modified areas compared to the unmodified surface. At the same time, the values of the NW density for the regions, formed at accelerating voltages of 10, 20 and 30 kV, are approximately equal to 6.4 μm^{-2}, 6.08 μm^{-2} and 6.24 μm^{-2}, respectively, which is ~ 2.5 times greater than outside the modified region. The average length and diameter values of the obtained NWs are also approximately equal: 3.23 ± 0.58 μm and 55.7 ± 5 nm; 2.83 ± 0.56 μm and 56 ± 5 nm; and 2.97 ± 0.64 μm and 58 ± 6 nm for 10, 20 and 30 kV, respectively. At the same time, the NW length outside the modification area is 1.5 times longer (4.44 ± 0.41 μm) due to the lower NW density. However, the diameter is almost equal to the values within the modified areas (61 ± 5 nm) which may indicate an approximately identical (in size) ensemble of initial catalyst droplets (Ga). Thus, it can be concluded that the magnitude of the accelerating voltage and, consequently, the distribution of ions in the near-surface layer don't affect the parameters of the NW ensemble, and the characteristics of nanocrystals are completely determined only by the implantation dose amount. Raman spectroscopy has shown that an increase in the accelerating voltage leads to a significant raising in the defectiveness of the treated areas. The intensity of the TO-phonon line (521 cm^{-2}) decreases by almost an order of magnitude (8 – 10 times) for a voltage of 30 kV due to the higher ion energy and, therefore, a larger number of generated defects. However, annealing completely restores the Si structure within the modification area. This leads to the fact that NW arrays are formed with identical characteristics within areas with different FIB processing modes. Thus, it can be concluded that

the magnitude of the accelerating voltage and, consequently, the ions distribution in the near-surface layer, when using an all-over processing pattern, have practically no effect on the NW ensemble parameters. At the same time, the effect of the dose on the NW parameters cannot be explained by the formation of catalytic centers due to the segregation of embedded Ga atoms during annealing. Apparently, this is due to the feature of the ion's interaction during ion-beam treatment with the near-surface layer of the substrate and requires further study.

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Study on Aluminum Pastes in Back Electrode for Silicon Solar Cells

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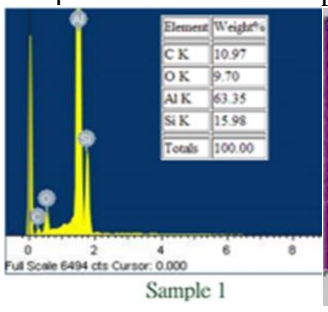
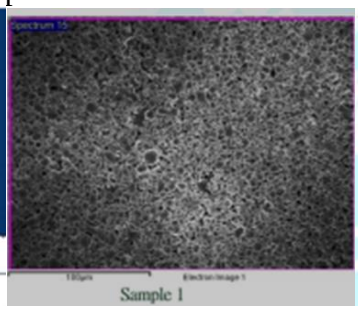
In this study, the homemade conductive aluminum paste with composed of the various aluminum powder particle size, with the various ratios of glass powder and aluminum powder and with the additives onto back electrode of the silicon solar cells would identify the optimal composition through its electrical properties and material characteristics. The electrical properties include open circuit voltage, short circuit current, fill factor, conversion efficiency through the solar simulator, and the material issues are analyzed through the surface structure, scanning electron microscopy (SEM) and energy dispersive spectrometry (EDS) analysis. The smaller aluminum powder (4 μm) of the conductive aluminum paste provides a better density and lower sheet resistance. The optimal ratio of glass powder and aluminum powder is 1:15 and then produce a 2.59 % improvement in fill factor of commercial data.





	Isc	Voc	FF	Eta
Sample 1-1	8.169	0.621	75.178	15.97%
Sample 1-2	8.112	0.619	74.806	15.73%
Sample 1 Avg	**8.140**	**0.620**	**74.992**	**15.85%**
Sample 2-1	8.100	0.615	66.870	13.96%
Sample 2-2	8.089	0.615	74.924	15.60%
Sample 2 Avg	**8.094**	**0.615**	**70.897**	**14.78%**
Sample 3-1	7.954	0.606	72.590	14.65%
Sample 3-2	7.954	0.608	66.402	13.45%
Sample 3 Avg	**7.954**	**0.607**	**69.496**	**14.50%**

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Mössbauer Studies of Magnetic Phase Transitions in Multiferroic $BiFeO_3$-based Solid Solutions with Ordered and Disordered $AFe_{1/2}B_{1/2}O_3$-(A = Pb, Ca, Sr, Ba, $(Na_{1/2}Bi_{1/2})$; B = Nb, Sb) Perovskites

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Compositional dependences of magnetic phase transition temperature T_M for lead-free perovskite solid solutions of $BiFeO_3$ (BFO) with the highly-ordered complex perovskites $PbFe_{1/2}Sb_{1/2}O_3$ (PFS), $SrFe_{1/2}Sb_{1/2}O_3$ (SFS) and their disordered counterparts $PbFe_{1/2}Nb_{1/2}O_3$ (PFN), $CaFe_{1/2}Nb_{1/2}O_3$ (CFN), $SrFe_{1/2}Nb_{1/2}O_3$ (SFN), $(Na_{1/2}Bi_{1/2})Fe_{1/2}Nb_{1/2}O_3$ (NBFN) were studied using Mössbauer spectroscopy. Ceramic samples of BFO – AFS (A = Pb, Sr) were obtained using high-pressure synthesis at 4 – 6 GPa [1] and those of BFO – AFN (A = Ca, Sr, $(Na_{1/2}Bi_{1/2})$, Ba) by usual solid-state synthesis at atmospheric pressure. For solid solutions of BFO with PFN, PFS and NBFN the $T_M(x)$ curves are smooth, while those for BFO – AFN (A = Ca, Sr, Ba) ones with the highly-ordered complex perovskite $PbFe_{1/2}Sb_{1/2}O_3$ (PFS) concentration dependence of T_M is close to the theoretical $T_M(x)$ curves [2], calculated for the case of the ordered distribution of Fe^{3+} and non-magnetic Sb^{5+} ions in the lattice. In contrast to this $T_M(x)$ dependences for BFO – AFN (A = Ca, Sr, $(Na_{1/2}Bi_{1/2})$, Ba) solid solution compositions with $x <$ 0.6 are close to the $T_M(x)$ dependence for $BiFeO_3$ solid solution with disordered perovskite PFN plotted using the results of the magnetization and Mössbauer studies [1, 2]. It is worth noting that for the latter system, experimental T_M values are somewhat lower than those calculated for the case of the disordered distribution of Fe^{3+} and non-magnetic B^{5+} ions in the lattice [2] (see Fig. 1). This ordering is likely to be a short-range and local and thus not detectable by the XRD. However, for compositions with $x > 0.6$, the $T_M(x)$ dependences show an abrupt drop down to $T_M \approx 50$ K. These drops in the $T_M(x)$ curves are seen in the $x \approx 0.65 – 0.75$ range, that is close to the percolation threshold for Bi^{3+} ions in the A-sublattice. Thus, the results obtained seem to be experimental evidence of the magnetic superexchange between Fe^{3+} ions via the empty 6p-states of Bi ions theoretically predicted for $BiFeO_3$ [3]. The experimental results are supplemented by density functional theory and Monte-Carlo studies of magnetic exchange interactions and magnetic ordering in the BFO-based solid solutions.

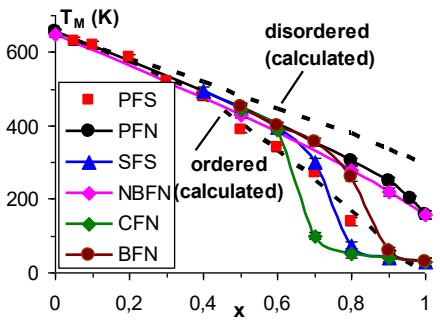

Fig. 1. T_M *vs* x dependence for $(1 – x)BiFeO_3 – xAFe_{1/2}B_{1/2}O_3$-($A$ = Pb, Ba, Sr, $(Na_{1/2}Bi_{1/2})$ Ca; B = Nb, Sb) solid solutions. Broken lines show $T_M(x)$ dependences calculated for the cases of the ordered and disordered distribution of Fe^{3+} and non-magnetic B^{5+} ions in the lattice [2].

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Delamination Detection in a Multilayer Carbon Fiber Reinforced Plate Based on Acoustic Methods: Numerical and Experimental Study

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This study is motivated by the goal of improving non-destructive testing techniques for load-bearing composite structures, which typically have orthotropic structural symmetry, using Lamb waves, generated by piezoelectric actuators. Lamb waves are used in active control systems, since they can propagate over long distances in thin-walled composite parts, directly interact with potential defects, which allows assessing the health of the structure. The most interesting advantages of using Lamb waves are their ability to detect such defects in composites as delaminations, inclusions, porosity, and unwanted local changes in the mechanical properties of the material. The study was carried out in three main stages. The first stage involved excitation of zero-order asymmetric Lamb waves, generated by a disk PZT actuator in the composite panel. The studied thin flat square plate was an 8-layer symmetrical carbon fiber laminate with transverse anisotropy. To simulate a defect such as delamination in the middle plane of the plate between the 4-th and 5-th layers at the stage of manufacturing the panel, inclusions of a rounded shape from a porous material of various diameters were placed. In the center of the panel there was a disk PZT actuator with a diameter of 50 mm, which generated wave packets at carrier frequencies in the range of 30 kHz. The field of out-of-plane velocities on the entire surface of the plate was controlled by a laser Doppler vibrometer pointed at points on the surface. At the second stage, a finite element model in COMSOL Multiphysics package was developed that fully reproduced the experimental conditions, including the dimensions, elastic and damping properties of the panel under study, the geometry and arrangement of the delaminations, and the properties of the PZT actuator. Comparison of the results of numerical simulation and experimental ones showed a qualitative and, to a sufficient extent, quantitative convergence of the results. The third stage consisted in a numerical study of the influence of the defect parameters on the wave field of the panel, based on the model verified at the second stage. In particular, the dependence of the amplitude of out-of-plane velocities in the vicinity of a defect on the depth of the latter was obtained. As a result, a significant excess of the amplitudes of out-of-plane velocities in the delamination region was theoretically established and experimentally

confirmed. The features of the wavefront distortion near the defect made it possible to reliably localize the delamination using a simple laser vibrometer.
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Surface Effects in Nanosized Ferroelectric Heterostructures

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Barium-strontium-titanium (BST) solid solutions due to their unique properties are widely used in various fields of microelectronics [1, 2]. The thermodynamic theory developed for the entire series of these solid solutions [3] made it possible to calculate the thermodynamic potentials for films of the required stoichiometric composition [4] and construct phase diagrams for films of these compositions. This allowed one to determine the material constants for the linear equations of the piezoelectric effect, which are widely used in the development of devices, and the dependence of these constants on the magnitude of forced deformation and the phase state of the film [5, 6]. In this work, we develop a thermodynamic model for a BST-80 film, deposited on a (001) cut cubic substrate, which experiences uniaxial deformation. For a fixed misfit strain, the material constants are calculated for different uniaxial strains. The behavior of elastic moduli c_{ij} depending on the value of uniaxial strain u_x in the *bc*-*a* phases has been studied. It is shown that the moduli c_{22}, c_{23}, c_{24} and c_{44}, change anomalously near the boundary in *bc*-phase. At the *c*-*ac* boundary on the side of the *c*-phase, the modulus c_{55} changes significantly. In the *ac*-phase, all elastic moduli change anomalously, except for c_{22} and c_{24}. In the *a*-phase, after jumps at the boundary with the *bc*-phase, the elastic moduli c_{11}, c_{55}, and c_{66} change noticeably. The study showed that a change in the uniaxial strain u_x leads to a significant change in the functional characteristics of devices made using the BST-80 film [7]. The possibility of controlling the parameters of a surface acoustic wave, excited by a film on a limited silicon substrate and, thereby, demonstrating the possibility of efficient registration of deformation fields, is studied. In particular, the study of the *S*-parameters, which characterize the resonant properties of the SAW device, at a frequency near 274 MHz in the *a*-phase showed, that when the uniaxial tension changes in the *a*-phase, the resonance frequency changes within 4 MHz. The study of the *S*-parameters of the SAW device at a frequency of 522 MHz with a change in uniaxial tension in the *a*-phase showed that the resonance frequency varies within 18 MHz. This is natural, since the 512 MHz wave is more localized in the film, compared to the 274 MHz wave.

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Protective Properties, Microstructure and Physical Characteristics of Organic Films

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A benzimidazole derivative is a surface-active substance (SAS). Its salt with bromine anion (SAS•HBr) was investigated for corrosion of low-carbon steel in sulfuric acid solution. The surfactant concentration was 10^{-3} mol/l. The concentration of SAS•HBr varied within $(1 – 4)\times10^{-3}$ mol/l, the film formation time was exactly 1 day. We have found that the quantitative indicators of protection depend on the nature of the inhibitor and increase with the transition from the organic surfactant base to its salt SAS•HBr at the higher its concentration. To interpret the measurements obtained, capacitive and electrochemical dependences were obtained under similar conditions. The surface microstructure of the organic films was studied using a Carl Zeiss EVO 40 scanning electron microscope. According to impedance measurements, the transition from SAS to SAS•HBr increases the blocking effect by more than 4 times. An increase in the concentration of SAS•HBr is also accompanied by an increase in the degree of filling of the steel surface with organic inhibitor cations. Earlier studies have established that inorganic anions, adsorbed on the positively charged iron surface, played the role of anionic bridges between the metal surface and organic salt cations [1]. Graphical processing of capacitive measurements in the coordinates of the corresponding adsorption isotherms allowed one to state the presence in the adsorption layer of significant electrostatic interaction between the cations of the organic surfactant and bromine anions, which increases with increasing salt concentration. On the base of quantitative parameters of electrochemical measurements (polarization of partial electrode reactions, the values of the corrosion potential, Taffel constants of polarization curves) it was found that the studied compounds are cathodic inhibitors. They increase the inhibition of the cathodic reaction of the discharge of hydroxonium cations and practically do not affect the anodic oxidation reaction of the surface metal atoms. When studying the microstructure of the films, it was found that all studied surfaces have a cellular-type structure. As for previously

studied similar organic films [2], the cells have an oblong shape and are separated by narrow channels. We found that the surface of the films, obtained in the presence of organic surfactant base is loose, porous with multiple micro-damages and wider and deeper channels. Apparently, these factors worsen the protection of steel against corrosion. The surfaces of films, obtained in the presence of organic salt, are different. They are characterized by larger cells, the number and size of which increase (from 2 – 8 to 40 – 48 μm) with increasing concentration of SAS•HBr, and a larger corrosion inhibition factor. The conductivity of the films depends also on the nature of the inhibitor. It has large value and increases by a factor of 5 – 8 in the transition from SAS to SAS•HBr. The reactance of all films has an inductive character, depends on the frequency of the measuring field, the concentration of SAS•HBr, the value of one-dimensional pressure, and indicates the hopping nature of the conductivity of these films.

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Electrical Conductivity and Protective Properties of Organic Films on Steel Surface

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The study of the electrical conductivity of organic materials is currently an urgent task. By varying the electrical conductivity, by rearranging the structure of macromolecules and changing the concentration of the alloying components, organic materials with the properties of metals, semiconductors, or dielectrics are obtained. They are based on flexible, light, miniature and cheap electronic devices such as LEDs, transistors, touch screens, solar cells, memory devices, etc. [1]. In this work, the electrical conductivity, morphology, protective and electrophysical characteristics of organic films on the surface of mild steel have been studied. In the formation of films as alloying components, there were used organic base class imidazole SAS (surface active substance, SAS), organic salt of SAS•HBr and composite additive SAS•HBr + KBr. The properties of the films, depending on the concentration of the organic component ($C_{SAS \cdot HBr}$), and the time of their formation t were studied. The concentration of KBr in all mixtures was kept constant ($C_{KBr} = 2 \times 10^{-3}$ mol/l) [2]. We obtained the volt-current characteristics of the films. It was found that at weak pressure, the conductivity G of 1 cm^2 films

grows from 0.4 to 2.5 s with increasing SAS-HBr concentration (t = const). Increasing the film formation time from 1 to 5 days also contributes to the growth of G of organic films by almost 2 times when $C_{SAS \cdot HBr}$ = const. It was found that the conductivity of the films is sensitive to the effects of pressure σ. As σ increases from 10^4 to 1.5×10^5 Pa, G increases by a factor of 5 – 10. Deformation of the films changes the shape of the macromolecules, with subsequent rearrangement of the fluctuation network nodes and displacement of the traps. The greater delay of the current through the film relative to the voltage on it contributes to the formation of a negative electrical capacitance of the film, the value of which is the greater, the larger σ. The study of the films, using a scanning electron microscope, showed that their surfaces have a cellular structure. Structural features such as the size and shape of the cells, the width and depth of the channels, which determine the protective properties of the film, depend on the time of film formation, the composition and concentration of inhibitors. When studying the inhibiting properties of organic additives, it was found that the introduction of surfactant into the sulfuric acid solution reduces the corrosion rate of steel by more than 4 times. The use of SAS•HBr as an inhibitor significantly increases the protective properties of the surfactant. The inhibitory effect increases even more when a composite inhibitor is used. The blocking-activation mechanism of the protective action of the studied additives was determined. The degree of steel surface shielding θ increases with the transition from SAS to SAS•HBr and further to SAS• HBr + KBr. In the same sequence, the polarization of the cathodic reduction reaction of hydroxonium cations and the slopes of the Taffel sections of the cathodic polarization curves (cathodic type of inhibition) grow.

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Peculiarities of the Protective Properties and Physical Characteristics of Organic Films on the Nickel Surface

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The results of studies of thin organic films, obtained by adsorption method from sulfuric acid electrolyte testify to the peculiarities of formation of the protective layer on the Ni surface compared to Fe [1]. The purpose of this work is to study in more detail the influence of organic compounds on the corrosion behavior of nickel in sulfuric acid and to investigate the physical characteristics of the obtained organic films. The corrosion behavior of Ni in H_2SO_4 in the presence of benzimidazole derivative surfactant (surface active substance, SAS) and its

analogues, namely benzimidazole hydrochloride SAS•HCl and binary inhibitor, additionally modified with potassium chloride SAS• HCl+KCl, was studied. The corrosion test time *t* varied from 1 to 5 days. The parameters of Ni corrosion inhibition such as corrosion inhibition coefficient *K* and protection degree *Z*, as well as parameters of adsorption behavior of inhibitors on nickel surface: capacity of double electric layer (DEL) *C* and degree of nickel surface shielding θ were determined. It was found that the introduction of SAS into the H_2SO_4 solution reduces the rate of corrosion of Ni. The use of SAS•HCl as inhibitor increases *K*. However, the additional introduction of chlorine anions in the form of KCl into the inhibitor reduces the protection of nickel to an initial value. The adsorption of the inhibitor components increases monotonically in this case, as evidenced by a decrease in the DEL capacity and an increase in θ. The obtained dependencies are interpreted on the basis of the peculiarities of metal corrosion inhibition by anodic-type compounds, such as the investigated inhibitors for nickel corrosion. For such inhibitors, the molecules (cations) of the inhibitor may be displaced from the intermediate surface complex by an excess of the halide anion, which probably reduces the degree of protection [2]. The obtained nonlinear dependences of the protective effect, as well as the conductivity *G* and electrical capacity *C'* of the formed films, on the composition of the inhibitor are typical only for the adsorption of inhibitors onto the Ni-substrate. The protective properties of the studied additives during Fe corrosion under similar conditions showed an increase in both the degree of protection and the conductivity and electrical capacity of the films with increasing concentration of chloride anions in the inhibitor composition. The effect of the formation time of the adsorption film on the surface of the studied metals on their inhibitory properties was studied using SAS•HCl as an example. The protective properties of the film on the Ni surface decrease monotonically with increasing organic salt adsorption time, while the opposite effect is observed for Fe. The conductivity (*G*) of films is high and the electrical capacity (*C'*) is large and negative for both Ni and Fe. Both *G* and *C'* increase, when subjected to one-dimensional pressure, and their voltammetry characteristics have sections with negative differential resistances. However, as *t* increases, the values of *G* and *C'* of films on Fe increase many times, and a weakly pronounced inverse effect is observed for Ni films [1, 3]. A study of the structure of the adsorption films on the Ni and Fe surfaces, using an electron microscope, confirmed their significant difference.

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Investigation of Co-Sputtering Al-Ga-Zn-O Thin Film Transistors

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This work demonstrated the AlGaZnO thin film transistors (TFTs) of various ZnO:AlGaO power ratio, fabricated by co-sputtering method. During the co-sputtering process, the power of ZnO target were kept at 60 W, whereas the power of AlGaO target were varied with three ratios of 20 W, 40 W, and 60 W, respectively. To further investigate the effect of channel thickness on the AlGaZnO TFTs, different channel thickness of the optimized power ratio of AlGaZnO thin film were also deposited. Through *I-V* transfer characteristic measurement, several figures of merit of TFTs were obtained and discussed in this work, including threshold voltage (V_{th}), on/off ratio, mobility (μ), and subthreshold swing (SS). The optimal characteristics of AlGaZnO TFT were obtained at the ZnO: AlGaO power ratio of 60 W:60 W, with the channel thickness of 20 nm. The corresponding V_{th}, on/off ratio, mobility (μ), SS was of 0.96 V, 1.01×10^7, 0.04 $cm^2/(V\cdot s)$, and 0.33 V/dec, respectively. Moreover, the oxygen vacancies, varied with different ZnO:AlGaO power ratio, were obtained through XPS analysis. Among the various power ratio, the oxygen vacancies were the least and the resistance was the highest under the ZnO:AlGaO power ratio of 60 W:60 W, lead to the optimal device performance. Furthermore, the change in the V_{th}, mobility [1], and SS [2] caused by the variation of channel thickness, were also be discussed in this study.

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Study of Relaxation Processes in the Superficial Tissues of a Patient Using Bioimpedance Analysis

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Bioimpedance analysis is a contact method for measuring the electrical conductivity of biological tissues, which makes it possible to assess a wide range of morphological and physiological parameters of the body. The method is based on measuring the electric impedance *Z* of the whole body or individual segments of the body using impedance analyzers. Various methods and designs of diagnostic probes were proposed for bioimpedance measurements of individual segments and local areas, in particular, the skin and subcutaneous adipose tissue in arbitrary areas of the patient's body. In the present work, relaxation processes, occurring in the superficial tissues (skin, subcutaneous adipose tissue) of a patient under external influences, were studied using a previously developed method and diagnostic probe design for non-invasive bioimpedance spectroscopy [1]. The distinguishing feature of the proposed method is the ring shape of the diagnostic probe with the possibility of vacuum fixation of the studied biological tissue inside the probe. Measurements of the electrical impedance spectra of reference solutions and superficial tissues of the patient were performed using a measuring setup and a developed diagnostic probe. The LCR Hi Tester HIOKI 3532-50 was used for impedance measurements. Data collection and processing was carried out using the PRAP software package. Control measurements of the impedance spectra were performed on standard solutions (alcohol, water, saline solutions). Since vacuum fixation of surface tissues is used in measurements of impedance spectra *in vivo*, it was of interest to study the transient and relaxation processes in the studied tissues under the action of vacuum suction, which is often used in massage and other therapeutic procedures. It was found that the impedance of the surface tissue, measured at a frequency of 3 kHz, decreases from 6 to 1 kΩ within 60 seconds, and the dependence was exponential. The change in impedance, in this case, is due to the gradual influx of blood and lymph to the surface tissue area under the study, caused by vacuum suction. In contrast to the known relaxation mechanisms (dielectric polarization decrease with increasing frequency due to various effects, occurring in intracellular structures, as well as the Maxwell-Wagner effect) the observed relaxation of the superficial tissue impedance with a characteristic time of about 60 seconds is due to a decrease in active resistance *R* due to an increase in the content of conductive fluid in tissues. The results obtained allow us to conclude that the impedance of biological tissues, determined for a given frequency of electrical voltage, can change significantly under the influence of physiological factors. This makes it possible to use the developed method of bioimpedance spectroscopy and a ring-shaped diagnostic probe for quantitative assessment of the condition of the patient's surface tissues in various diseases, as well as to monitor and evaluate the effectiveness of physiotherapy and other therapeutic effects.

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Switching Processes and Ferroelectric Hysteresis in Porous PZT Type Piezoceramics

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Ferroelectrics are a technologically important class of materials that are used in sensors, actuators, ultrasonic transducers, and memory devices. Introducing porosity into these materials offers a method of tuning its functional properties for certain applications, such as piezo- and pyroelectric sensors, ultrasonic transducers and energy harvesters. The interest towards porous ceramics has grown rapidly in recent years with the increasing demand for specific properties and features that generally cannot be achieved by their dense counterparts. The ferroelectric hysteresis (polarization *vs* electric field) is a defining property of ferroelectric materials. Porous ferroelectric ceramics possesses usually remarkably less polarizability than dense ceramics; instead of they display high tenability of various physical properties. However, the effect of porosity on the polarization switching behavior of ferroelectrics, which is the fundamental physical process, determining their functional properties, remains poorly understood. In part, this is due to the complex effects of porous structure on the local electric field distributions within these materials [1]. In present work, particular aspects of the switching properties of the PZT-type porous piezoceramics with relative porosity up to 40 % were investigated by comparison with the dense piezoceramics of the same composition. PZT type dense and porous piezoelectric ceramics of the composition $Pb_{0.95}Sr_{0.05}Ti_{0.47}Zr_{0.53}O_3$ + 1% Nb_2O_5 with relative porosity from 0 up to 40 % and average pore size of 10 – 30 μm were chosen as the object of the study. Porous PZT samples were fabricated using the pore former burning-out method. A dense PZT samples with the same chemical composition were fabricated by conventional sintering method. Field-dependent polarization and strain loops were recorded at the bipolar electric fields in the range of 0 – 5.0 kV/mm and in the frequency range of 0.01 – 5 Hz, using a sinusoidal waveform. Measurements and analysis were performed by means of the Electromechanical Measurement System (STEPHV) and Electromechanical Response Characterization Program (STEP) from TASI Technical Software Inc., combining large signal modelling of the mechanical and electrical behavior of ferroelectric materials. Analysis of large-signal macroscopic polarization and strain hysteresis loops made it possible to obtain full sets of parameters, characterizing the switching processes and ferroelectric hysteresis behavior of the porous and dense piezoceramics, and understand the effect of porosity on the polarization-field response of ferroelectric materials. It was shown that the differences in switching behavior of dense and porous piezoceramics are due to the specific features of the domain structure and microstructure of porous piezoceramics. The resulting information provides new insights in the interpretation of the physical properties of porous ferroelectric materials to inform future effort in the design of ferroelectric materials for piezoelectric sensor, actuator, energy harvesting, and ultrasonic transducer applications.

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Ultrasound Diagnostics of the Patient's Superficial Tissues

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The use of ultrasound as a valuable diagnostic and therapeutic agent has now become so widespread in certain fields of clinical medicine that it may be considered integral to proper medical treatment of patients. Data on the variations of velocity, acoustic impedance, absorption, scattering, and attenuation within a certain tissue are used in practice to characterize its structure. Ultrasound measurements of individual segments and local areas of the body using standard ultrasound methods and transducers are difficult due to deformation and changes in the size of the measured soft tissue Thus, it is fair to say that novel ultrasonic methods for examination of the conditions of biological tissues and physiological processes, occurring in them in the process of therapeutic treatment of a patient, are much needed. In this report, we propose a new method and a universal design of an ultrasonic diagnostic module for non-invasive diagnostics of the condition and physiological processes in superficial tissues (skin, subcutaneous adipose tissue) in an arbitrary part of the patient's body *in vivo*. Measurement of the propagation velocity and attenuation of ultrasonic waves in reference solutions and superficial tissues was carried out using transmission and echo-pulse ultrasonic methods. The measuring bench included a LeCroy Wave Surfer 422 digital oscilloscope, a Panametrics (Olympus) 5077 PR pulser/receiver, and a developed ultrasound diagnostic module. The design of the ultrasonic diagnostic module was assumed for temporary fixation of the examined superficial tissue by means of vacuum suction and simultaneous measurement of the velocity and attenuation of ultrasonic waves. The diagnostic module was a plastic cup, connected to the vacuum system, in the body of which a cylindrical ultrasonic transducer was mounted, which was a piezoceramic cylinder with an outer diameter of 64 mm, a thickness of 2 mm and a height of 5 mm, made of PZT piezoceramic, and connecting cables. The ultrasonic transducer was connected to the input connectors of the pulser/receiver and the oscilloscope. The cylindrical ultrasonic transducer was used both as an emitter and as a receiver of ultrasonic waves. The velocity of ultrasonic waves propagation in reference solutions and superficial tissues was determined using the transmission and echo-pulse methods by measuring the time of propagation of an ultrasonic pulse through the studied medium. Measurements of sound velocity and attenuation of ultrasonic waves in surface tissues *in vivo* were performed on various parts of the patient's body using a pre-calibrated diagnostic transducer. The body was heated through a transparent transducer cup with an infrared heater. The body surface temperature was monitored by a built-in thermocouple. These measurements were repeated at least three times

at each temperature with a repetition period of 5 min to allow for superficial tissue recovery after vacuum suction. It was found that any changes in body temperature, as well as the condition of its structural components, lead to registered changes in the velocity of sound and the relative attenuation of the ultrasonic waves. In addition, the speed and attenuation of ultrasound in biological tissue change dramatically during therapeutic treatment, reflecting physiological processes and modification of the structure and composition of the tissue (lysis of adipose tissue, dehydration, necrosis, coagulation, blood filling). This makes it possible to use the developed method and the ultrasound diagnostic module for non-invasive diagnostics and monitoring of the condition of the patient's surface tissues in various diseases, as well as to monitor and evaluate the effectiveness of physiotherapy and other therapeutic interventions.

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The Negative Electric Capacity of Organic Films on the Surface of the Rolling Steel

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Recently, a large variety of materials and devices with inductive impedance or a negative active component of the complex capacitance ($C' < 0$) have been discovered. It has been observed in composites and nanocomposites, in crystalline and amorphous semiconductors, in organic compounds and in geological samples, in Schottky barrier diodes, in heterostructures and in metal-dielectric-metal structures [1]. Earlier [2], when studying the protective properties of organic films on the surface of rolling steel, it was found that their capacities are negative regardless of the film formation time, inhibitor concentration and type. In the result of analysis of the experimentally obtained frequency dependences of $C'(f)$, a mechanism causing the appearance of negative capacitance in these films was proposed. This is the process of development of relaxation polarization with inverse electric field strength [3]. In this report, the method of impedance spectroscopy was used, as before [3], to simulate relaxation processes occurring in the films. A similar electrical *RC* circuit is chosen as the substitution circuit of the element of the studied film. Its equivalent circuit is three parallel branches, containing resistor R_1, capacitor C_1 and a branch of series connected resistor R_2 with capacitor C_2, respectively. Taking into account the inverse of the electric field, the capacitance of capacitor C_2 is chosen negative. The frequency dependences of the real part of the complex capacitance $C'(f)$ and the imaginary component of the complex conductivity $G''(f)$ have characteristic features. Therefore, an analysis of these dependencies was performed in order to determine the relationship between the values of R_2 and C_2 and the nature of the behavior of $C'(f)$ and $G''(f)$. Organic films were obtained on the surface of rolling steel by adsorption of different inhibitors: organic base of imidazole surface-active substance (SAS) class, organic salt of SAS•HBr and composite additive SAS•HBr + KBr. Variable factors in obtaining the films were the concentration of the organic component and the time of their formation. Frequency dependencies of capacitance, dielectric loss angle tangent, active, reactive and complex resistances are measured using E7-30

immittance meter in frequency range (25 – 3×10^6) Hz. At low frequencies (from 2×10^2 to 3×10^4) Hz, the capacitance of the films is practically unchanged. Dielectric dispersion, pronounced relaxation processes were observed in the frequency range (3×10^4 – 3×10^6) Hz. Thus, when the frequency increases by an order of magnitude, the capacitance modulus C' decreases by about two orders of magnitude. The experimentally obtained results for films obtained under different conditions are compared with the theoretically calculated frequency dependences. The matching results of $C'(f)$ and $G''(f)$ can be regarded as good. The correlation of the obtained data of resistance R_2 and capacitor C_2 of the modeling circuit with the experimental dependences of films of different types and the influence of film formation conditions on their properties are discussed. The negative contribution of relaxation processes to the polarization of the films, and hence to their dielectric permittivity and electrical capacitance, decreases with increasing frequency. At some even higher frequency f_0, the negative contribution of relaxation processes disappears completely. This frequency is evaluated. For the substitution scheme with values of $R_2 = 1$ Ω, $C_1 = 10^{-8}$ F and $C_2 = 7\times10^{-7}$ F, $C' = 0$ at the frequency $f_0 \approx 10^7$ Hz. The frequency f_0 decreases by an order of magnitude, when R_2 increases by an order of magnitude. The electrical capacitance of the films C' at the frequency f_0 is zero, that is the resistance of these films is purely active.

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Excitation and Reception of Vibrations by Inhomogeneously Polarized Piezoceramic Transducers in an Acoustic Waveguide

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The processes of wave propagation in acoustic circular waveguides are considered taking into account the source and receiver of oscillations in the presence of attenuation through the side surface. The vibration receiver is in contact with the gasket, which is simulated by the Kelvin-Voigt medium. The finite dimensions of the acoustic waveguide and transducers lead to signal reflection, which demonstrates itself in the amplitude-frequency characteristics (AFCs) of this acoustic system. By changing the polarization of the ceramic emitter and vibration receiver, it is possible to significantly change the spectral characteristics of the acoustic system. The functional nature of the polarization inhomogeneity is selected in such a way as to amplify the signal amplitude in a certain frequency range. The energy leakage through the elastic surface limiting the waveguide was modeled using the impedance attenuation model. The generation of oscillations in the source generates harmonic waves in the waveguide, which are recorded by the oscillation receiver. The source and receiver are piezoceramic transducers with longitudinal

inhomogeneous polarization of the same structure. The complete system of equations includes the equations of electro elasticity and the acoustic medium. For electro elastic media, the finite element method is used. In the waveguide region, an axisymmetric problem is solved for an acoustic fluid, which leads to a spectral problem. The spectrum of complex roots is investigated. The conditions for conjugation of solutions at the interfaces of the acoustic liquid and ceramic transducers are satisfied in the integral sense. The boundary conditions for the receiver are supplemented by the equation of current flow through an external circuit with a given complex conductivity. Numerical experiments were compared with the solution of simplified problems for uniform polarization and no damping. The results of the work can be used for medical purposes to study blood vessels with elastic walls. They are also of interest when modeling a non-stationary solution to a problem.

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Determination of the Size of Core-shell Nanoparticles by X-ray Photoelectron Spectroscopy

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Recently, interest has been growing in the use of X-ray photoelectron spectroscopy not only to study the chemical bond on the surface and in the bulk of core-shell nanoparticles, but also their dimensional characteristics [1 – 3]. In this report, we discuss a simple analytical expression relating the core radius, nanoparticle shell thickness, and intensities of X-ray photoelectron lines from the core and shell. Using this equation, the dimensional parameters of core-shell nanoparticles, made of different metals ($Me_1@Me_2$) and metal and oxide ($Me@MeO_x$), were estimated and compared with the results of calculations using methods known in the scientific literature.

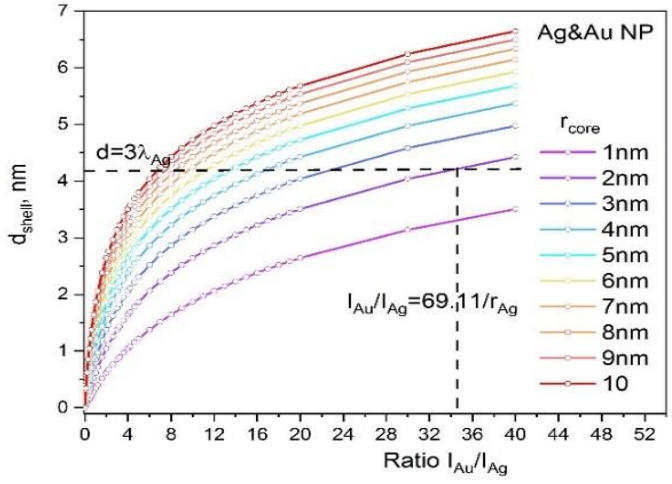

Fig. 1

In addition, the equation obtained makes it possible to use elemental composition data, obtained by X-ray microanalysis with an electron probe and registration with a solid-state detector (EDS) to calculate the thickness of nanoparticle shells. Comparison of the calculated size parameters of nanoparticles with the sizes of nanoparticles obtained, using the method of transmission electron spectroscopy, showed good agreement.

Figure 1 shows the dependences between the shell thickness d_{shell} and the intensity ratio I_{shell}/I_{core} for the radius r_{core} of the silver core in $Ag@AuNPs$ from 1 nm to 10 nm calculated by our formula. It follows from the figure that the shell thickness increases with the core radius and with the measured intensity ratio I_{Au4f}/I_{Ag3d}. Vertical and horizontal dotted lines restrict the ranges of core radius r_{Ag}, intensity ratios I_{Au4f}/I_{Ag3d}, and the thickness of the analyzed layer $d = 3\lambda_{Ag}^{Au}$ in the case of using the alkaline.

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Investigation of the Output Parameters of a Nanogenerator Based on Nitrogen-Doped Carbon Nanotubes

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Over the past decade, the number of wearable devices has grown significantly. This fact has created interest in creating new power sources that can reduce the frequency of charging from the power network or even replace it. A promising direction of development in this area is the creation of piezoelectric nanogenerators capable of converting external mechanical vibrations into electric current [1, 2]. Nitrogen-doped carbon nanotubes (N-CNTs) have shown themselves as promising materials for the development of such nanogenerators and have a number of advantages over known piezoelectric materials [3 – 5]. In the framework of this work, the output parameters of a nanogenerator based on single N-CNTs were estimated based on modeling and experimental studies. An array of N-CNTs, grown by plasma chemical vapor deposition in ammonia and acetylene flows, was used as an experimental sample. The growth temperature was 550 °C. The average diameter and height of nanotubes in the array were 82.5 ± 21.9 nm and 0.90 ± 0.15 μm, respectively. The output parameters during the deformation of N-CNTs were measured with a built-in oscilloscope of an atomic force microscope (AFM). The AFM probe was brought into contact with the top of the N-CNT and pressed on it during the measurement with a force of 1.18 μN. The output parameters of N-CNTs with a diameter of 80 nm and a height of 1 μm were modeled using a constant force of 1 μN using the COMSOL Multiphysics 6.1 software package. The experimentally measured value of the generated N-CNT current was –32.1 nA, which corresponded to an output voltage of about –0.32 mV. The output voltage obtained by modeling the process of deformation of a single N-CNT was –0.316 mV. The analysis of the obtained results showed that the values of the output parameters obtained experimentally and on the basis of modeling correlate well, which indicates the high adequacy of the model used. This model makes it possible to estimate the output parameters of the nanogenerator without the need to form an array of N-CNTs with specified geometric

dimensions. A theoretical estimate shows that with an increase in the length of a nanotube, the value of the generated potential increases exponentially, and decreases linearly with an increase in diameter, which is associated with a change in the value of its deformation at a given force. Thus, at a length of 2 μm and a diameter of 60 nm, the potential at the top of the N-CNT increases to –0.58 mV. In this case, the output current of the nanogenerator should increase in proportion to the number of N-CNTs that are in contact with the top electrode, which will make it possible to develop nanogenerators with a power of up to tens of μW. Thus, it is shown that the output parameters of the nanogenerator can be controlled by changing the geometric parameters and the number of N-CNTs. The data obtained can be used in the development of piezoelectric nanogenerators based on N-CNTs.

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Identification of the Distribution of Porosity in a Functionally Graded Piezoelectric Bimorph with a Quadratic Distribution of Properties

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Devices for the harvesting and accumulation of "green" energy are currently widely used as autonomous sources of electrical energy in various fields. Such energy can be wind, solar, wave energy, dissipated mechanical energy, etc. Often, the working element of these devices is a piezoelectric generator (PEG). In the case of using the energy of mechanical vibrations, effective PEGs are layered plates with piezoelectric layers. For their calculation and optimization, applied theories can be constructed that reduce the problem in the case of steady oscillations to a system of ordinary differential equations with constant coefficients. The basis for the construction of these theories is the adoption of hypotheses about the distribution of mechanical and electric fields. The use of a nonlinear representation of the electric potential may be necessary in the problems of modeling oscillations of functionally graded (FG) plates and multilayer piezoelectric transducers. In this regard, we previously obtained an applied theory describing the bending vibrations of the FG bimorph plate, in which the material properties are distributed according to a power quadratic law. It showed good convergence with the results of the finite element calculation. In this study, within the framework of the developed applied theory, the possibility is considered, based on the characteristics that can be obtained in a full-scale

experiment, to determine the porosity configuration that a sample under study may have. Characteristics that can be determined experimentally include resonant frequency, deflection under mechanical or electrical excitation, and the electrical potential that occurs when mechanically loaded. To do this, at the first stage, the dependences of the main characteristics on the degree of porosity near the surface and in the center of the plate were considered. Since there are two such variables, the dependencies are surfaces. In addition, projections of level lines on these surfaces onto a plane were also constructed, which are a set of isolines. At the second stage, based on the combination of two sets of isolines of various parameters, diagrams were constructed, on the base of which two curves can be obtained for a particular case of output parameter values. Three cases of isolines location were established: (i) the curves do not intersect, (ii) the curves intersect once, and (iii) the curves intersect twice. The case when the curves intersect once makes it possible to unambiguously determine the porosity configuration of the sample. It was also found that the best results are obtained by combining the isolines of the dependence of the displacement of the free end of the plate during electrical excitation and the first resonant frequency on porosity.

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Applied Theory of Vibrations of a Composite Electromagnetoelastic Bimorph with Damping

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In this work, forced oscillations of a layered composite bimorph, consisting of alternating piezoelectric and piezomagnetic layers, under the influence of mechanical, electric and magnetic fields were studied. Similar designs can be used as a piezoelectric generator (PEG), sensor or actuator. The use of such a bimorph as a PEG will make it possible to obtain energy not only from the external action of mechanical vibrations, but also from the action of an external alternating magnetic field, which in turn will expand the scope of PEG. An alternating magnetic field can be associated with some electromagnetic device or be artificial. PEGs are usually modeled using finite element (FE) software packages or numerical-analytical methods. At present, there are no ready-made solutions for FE modeling in the field of electromagnetoelasticity. However, you can use the interface for solving differential equations in partial derivatives or in a weak formulation. This is possible, for example, in COMSOL Multiphysics. Previously, we developed [1] an applied theory and a FE model in COMSOL Multiphysics, describing the oscillations of an electromagnetoelastic bimorph, which showed good convergence of the results. However, when modeling devices that oscillate in the resonance region, damping must be taken into account in order to more accurately describe output characteristics such as deflection and output electrical potential. Here, as in [1], it is

assumed that the considered composite material is a package consisting of alternating piezoelectric and piezomagnetic layers. Therefore, to simplify the problem, when describing the layers of a piezoactive bimorph, we will use the effective physical constants of a multilayer package. Applied theory is based on hypotheses about the distribution of mechanical, electric and magnetic fields using the variational principle. Damping is introduced by taking into account mechanical losses. All unknown variables are assumed to be complex-valued. The resulting system of equations and boundary conditions consists of real and imaginary parts. Within the framework of the constructed theory, the problem of finding the natural frequencies of the plate is solved, the values of the mechanical, electrical and magnetic characteristics of the field, as well as their amplitude-frequency characteristics, are calculated.

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Reconstruction of the Porosity Distribution Function of a Functionally Graded Piezoelectric Bimorph

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The development and use of additive technologies in the field of printing piezoactive materials and devices based on them will allow in the future to create efficient transducers with desired properties for certain operating conditions. One of such promising areas is the printing of porous ceramics with the ability to control the degree of porosity. Such ceramics will have functionally graded (FG) properties, which means that when modeling devices, is based on them, it will be necessary to develop new approaches and methods. The basis for the construction of these theories is the adoption of hypotheses about the distribution of mechanical and electric fields. The use of a nonlinear representation of the electric potential may be necessary in the problems of modeling oscillations of FG plates and multilayer piezoelectric transducers. Previously, in the framework of the study of porous ceramics PZT-4, we obtained a set of effective material constants for discrete values of porosity from 0 to 80 percent with a step of 10%. On their basis, applied theories for bimorphs with a quadratic distribution of physical properties over thickness were built. Also, we previously obtained an applied theory describing the bending vibrations of the FG bimorph plate, in which the material properties are distributed according to a power quadratic law. It showed good convergence with the results of the finite element calculation. In this study, we will solve the inverse problem of restoring the properties of FG bimorph. At the first stage, based on a set of material constants and using spline approximation, continuous functions of the dependence of material constants on porosity were obtained. This made it

possible to simulate bimorph transducers with various types of porosity distribution over the thickness. On the base of the obtained distribution functions, two applied theories were constructed for the linear and quadratic law of porosity distribution. Within the framework of the theories obtained, the main output characteristics were built, such as resonant frequencies, electric potential and plate displacements. That is, such characteristics that can be determined from the experiment. At the second stage, based on the data obtained at the first stage, the inverse problem was solved using the approach of genetic algorithms. First, numerical experiments were carried out in which the influence of the distribution of porosity on the dynamic characteristics of the bimorph was studied. After that, a fitness function was built, which included the sum of the squares of the relative difference between the calculated and "measured" characteristics, namely: resonant frequencies, electric potential and deflection at certain points of the structure. As a result, it was possible to restore the form of the porosity distribution function with an acceptable degree of accuracy.

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Simulation of the Interaction of the Keratoprosthesis with the Cornea

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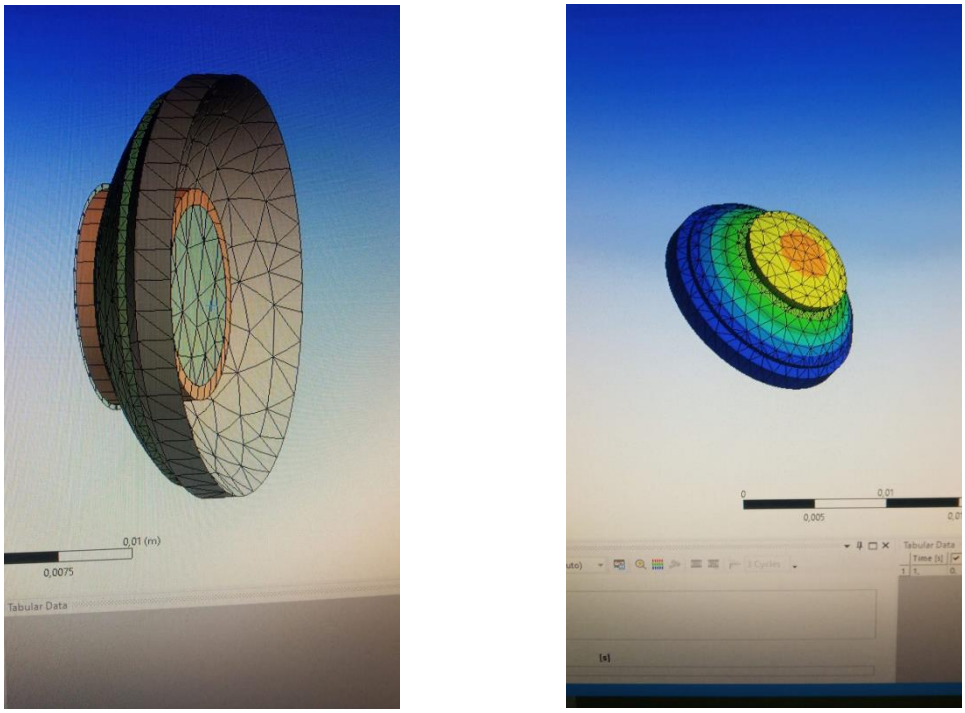
During implantation and operation, keratoprostheses are subjected to external and internal mechanical loads, which can lead to damage of biological tissues, with which the artificial implant to be in direct contact. Large deformations, displacements and the appearance of detachment between the keratoprosthesis and the layers of the cornea lead to necrosis of biological tissues and further partial or complete rejection. In this regard, the study and analysis of the stress-strain state of the cornea and the influence of the depth of haptic fixation on the state of contact between the layers of the cornea and keratoprosthesis were carried out in the work. Previously, the authors considered a similar problem in an axisymmetric formulation [1], and the present work includes the construction and analysis of a three-dimensional model. A 3D finite element model of a keratoprosthesis with a perforated annular support plate (haptics) inside the cornea (see Fig. 1a) was built using the ANSYS finite element software package. The optical part (optics) is a transparent cylindrical body, rigidly connected to the haptics. The lens diameter is 6 mm, which gives a larger field of view compared to the designs discussed earlier. The supporting element of the keratoprosthesis is more than 50 % perforated and has a diameter of 20 mm. Keratoprosthesis is made of polymer (polymethyl methacrylate). The complex biomechanical structure of the cornea was taken into account, which consists of five layers of different thicknesses with different mechanical properties. For keratoprostheses, variants of geometric models with three types of location of the support element relative to the layers of the cornea are considered: surface position, as well as positions in the middle of the cornea and under the cornea. Keratoprosthesis parameters: a haptic thickness is equal to 1/5 on the inner part and 1/10 on the outer diameter of the cornea thickness; haptic opening angle is 60 – 80°; modulus of elasticity of the haptics is less than twice the modulus of elasticity of the optics. During the simulation, studies of the maximum displacements of the haptics and optics were

carried out for various options for fixing the haptics: in the lower, central and upper positions (see Fig. 1b). In the problem setting under consideration, a rigid connection is modeled between the cornea and a cylindrical haptic element, but in reality, these surfaces are in contact with the possibility of breaking the contact, therefore, the presence of tensile radial stresses on this interface boundary can lead to disruption of the connection between the cornea and the keratoprosthesis design. An analysis of the stress-strain state was carried out, depending on the depth of immersion of the haptics of the keratoprosthesis into the layers of the cornea.



(a) (b)

Fig. 1. Finite element model of a keratoprosthesis in the cornea (a), axial displacement of the keratoprosthesis under the action of intraocular pressure (b)

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Structure and Surface Properties of $BiFeO_3/Sr_{0.6}Ba_{0.4}Nb_2O_6/SrRuO_3/MgO(001)$ Heterostructures

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Thin films of active dielectrics, such as ferroelectrics and multiferroics, as well as heterostructures, based on them, attract great attention of the scientific community due to the prospects for their application in modern microelectronics. Bismuth ferrite $BiFeO_3$ (multiferroic with high phase transition temperatures and record polarization values) and barium-strontium niobate $Sr_{0.6}Ba_{0.4}Nb_2O_6$ (uniaxial ferroelectric relaxor with high values of piezo- and pyroelectric coefficients) were chosen. The $BiFeO_3/Sr_{0.6}Ba_{0.4}Nb_2O_6/SrRuO_3/MgO(001)$ and $Sr_{0.6}Ba_{0.4}Nb_2O_6/SrRuO_3/MgO(001)$ heterostructures were fabricated by RF cathode sputtering in an oxygen atmosphere. The thickness of the $BiFeO_3$ and $Sr_{0.6}Ba_{0.4}Nb_2O_6$ layers was 90 nm.

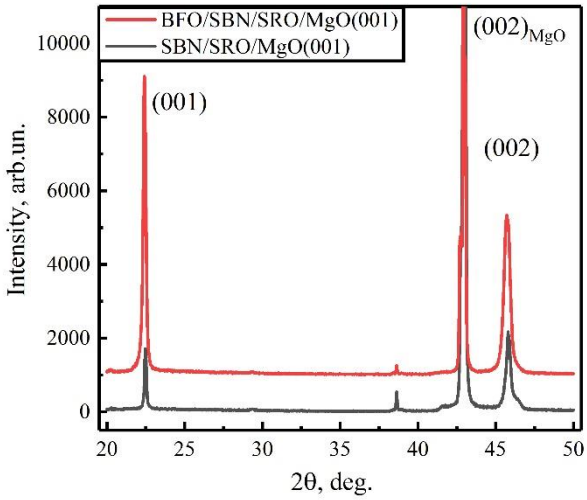

Fig. 1. θ-2θ X-ray diffraction patterns of $BiFeO_3/Sr_{0.6}Ba_{0.4}Nb_2O_6/SrRuO_3/MgO(001)$ (red line) and $Sr_{0.6}Ba_{0.4}Nb_2O_6/SrRuO_3/MgO(001)$ (black line) heterostructures

The crystal structure of the fabricated heterostructures were studied by X-ray diffraction (Fig. 1). It has been established that heterostructures are obtained without the formation of impurities at all stages of deposition, and the layers have a high structural perfection. The surface topography, as well as the ferroelectric and magnetic response of the surface, were studied by scanning probe microscopy. The surface of heterostructures is smooth with low roughness. By applying an external field, both positive and negative, it is possible to stably polarize the regions, the relaxation of which was more than 3 hours. In addition, a magnetic response was observed on the surface of $BiFeO_3$ layer.

Acknowledgements. The work was carried out within the framework of the SSC RAS state task (project number 122020100294-9) and financially supported by grant of the President of the Russian Federation MD-483.2022.1.2.

Enhancement of Shrimp Pond Productivity for the Community of Karanganyar Village

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One of the most promising commodities categories with development of potential is the conventional shrimp pond business. Given that Indonesia is one of the world's top producers of shrimp, the country's shrimp business may expand. By using shrimp ponds as a method of agriculture, the Karanganyar village community may take use of this chance to carry out growth in the shrimp industry sector. However, despite the enormous potential that exists in the Karanganyar Village setting, the innovations made by the community are insufficient. Because circumstances and conditions are always shifting in a variety of ways, innovation is necessary. Therefore, in order for the potential that currently exists to be fully realized and has an influence on local communities, innovation must also go hand in hand with it, where enhancing the wellbeing of rural people and the standard of living is the aim of village development. This prospective innovation is anticipated to offer a set of advantages both, the village authorities and the local village residents. Local communities can be empowered to participate in the tourist development process, maintain the environment, and acquire the skills necessary to build a community with a guaranteed degree of welfare via innovation, both in terms of location and effective management. In order to increase the welfare of the village community, the potential productivity development approach will be used inside the boundaries of Karanganyar Village.

Determination of Management Strategy Based on Performance Prism and SWOT Analysis (Case Study at Travel Avatar Magetan)

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In order to face the competition of travel services, the company must provide good service to customers, as well as travel Avatar Magetan as one transportation service in Magetan, Driven by Travel Avatar's unsuccessful target in 2013, research is needed to evaluate the company's performance and determine its strategy. It is important that companies can continue to compete with existing competitors. This research combines Performance Prism methods as performance of measurements and SWOT analysis (Strengths, Weaknesses, Opportunities and Threats) of strategies. The key performance indicators (KPIs) are the basis for measuring the company's performance. Using the OMAX (Objective Matrix) and Traffic Light System methods, we can know the activities of any company and its belonging to the red, yellow and green categories. Performance measurement and brainstorming it is then categorized into internal factors as strengths and weaknesses and factors of external opportunities and threats. A new company strategy will be developed based on this analysis. The results of the performance measurement

system are obtained by three stakeholders of its investors, customers and employees are identified with 16 KPIs. Based on calculations using the OMAX method, the company's overall performance was 7.72. By Traffic Light the system, showing 8 KPI, enters in the green category, 5 KPI enters in the yellow category, and 3 KPI enters in the red category. SWOT analyzes SO, ST, WO and WT. Strategy of SO recommends adding a departure schedule and working with the dealer motor vehicles, ST strategy recommends to give promo or discount price, WO strategy recommends conducting regular financial and management reports and review, scheduled training and development for employees, and WT strategy recommends to provide customer service facilities for customers, provide promotions and facilities added to customer.

Novel Design of Universal Filter using Differentiator Loop

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A new configuration for realizing the voltage-mode second-order universal filters using the op-amps is presented. By suitable arrangement of immittances of passive components, the high-pass, lowpass, and bandpass functions can be implemented simultaneously. Since the equivalent of an op-amp is a nullor, circuit transform can be applied to the presented circuit [1, 2]. The feasibility of the proposed filter functions is verified by HSPICE simulation [3, 4].

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Productivity Analysis with Objective Matrix (OMAX) Method on the Textile Company of PT. Icank Jaya

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Industrial development is currently growing rapidly, which has an impact on an increasingly competitive level of competition. This level of competition makes companies evaluate their

business processes in order to remain competitive with competitors. This evaluation can be done by monitoring the achievement of productivity so that the activities carried out are in accordance with the company's plans and targets (Agustina & Riana, 2011). Productivity is an indicator of a company's success in empowering its resources to produce targeted products (Setiowati, 2017). Productivity is related to production efficiency (Hardi et al., 2019) in the form of the ratio between the products produced and the resources used. This ratio will indicate the level of productivity of a company and can be used as management evaluation material for ongoing operational processes in creating more effective and efficient company activities (Wahyuni & Setiawan, 2017). The study was conducted in 2020, based on the company's historical data. Data processing uses the OMAX method based on data collected during the study. The data used in this study are data for the period from January 2020 to December 2020, namely manufactured product quantity, good product quantity, maintenance of product quantity, energy consumption, working hours, total machine damage, total machine data, material used, and weight data for each ratio. The weighted value of each ratio shows the priority percentage of production control work. The increase in the value of this ratio becomes an indicator of company productivity, based on the interests, demands and productivity requirements of the production department. The weighted values are presented by the production manager and 2 assistant production managers. The value set by the company is from 1 to 10, where the value 10 indicates the largest value and the value 1 is the smallest value. In measuring productivity with the Objective Matrix (OMAX) method, 6 criteria are used with output data, namely total products manufactured, good product data, defective product data, total working hours, normal hours, damaged hours and input data consisting of total normal working hours, working hours, number of workers, amount of labor used, criteria based on interviews with team leaders, supervisors, production managers.

A Novel Design of Motor-Bike Suspension System for Energy Harvesting

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In the recent era, the vehicle, used by a single man for transportation mostly, is a bike. Continuous depleting conventional source of energy and bad effect on the environment, draw the attention of the researchers to design and developed an efficient, eco-friendly energy system, which enables to recycle the west energy to run the vehicle. The electrical vehicle is the best alternative to reduce the pollution and economic viewpoint [1]. World-wide the electrification of small vehicles and cars is the most common trend and best step to solving the energy crisis and pollution problems [2]. In the most populated country such as India, the compound annual growth rate (CAGR) of electrical motor bike will be grown more than 22.1 % in the future [3]. The advantages of electric bikes include, cheaper to run, low maintenance cost, no harmful for the environment, safe to ride, and energy-saving compared the internal combustion engine motor bike [4]. Besides these benefits, there are various problems and challenges faced by the

engineers to develop the electrical vehicles and motor bikes. The cost of electric vehicles is a big factor compared the traditional vehicle even providing subsidy by the governments of several countries in the purchasing of electrical vehicles. The high-cost batteries of the vehicle are the main reason for the high price of the vehicles. Low efficiency due to the short-range of drive and longer time is taken in charging are additionally drawn back for electrical motor bikes [5]. To resolve the problems, the research has been done to harvest the west kinetic energy of the vehicle to boost efficiency and decrease the cost. Most of the parts of the driving energy, was dissipated into the heat and vibrations, whereas a small amount of energy was used for driving [6]. If the kinetic energy in the form of vibration can be converted into electricity and utilized by electrical vehicles, then the efficiency could be enhanced. Satpute et al. [7] proposed a hydraulic electromagnetic shock absorber to harvest the energy from the vehicle vibration. The main components of the harvester are a mechanical amplification, generator, and a fluid damper with displacement sensitivity. In another work, Fang et al. [8] fabricated and tested a hydraulic electromagnetic shock absorber (HESA) to perform both functions, vibration isolation, and energy scavenging from vehicle vibrations. Experiment results showed that approximate, 200 W can be recovered at 10 Hz and 3 mm amplitude of vibration. Shi et al. [9] designed and developed an energy-regenerative suspension system to harvest the energy from suspension vibration and simultaneously cost reduction of suspension. Experimentally it was found that the power of 46.57 W could be generated from the system. A linear electromagnetic transducer (LETs) was designed and optimized by Tang et al. [10] to harvest the energy from the vehicle suspension system. At RMS (root mean square) of 0.25 m/s of suspension velocity, an average electric power of 26 – 33 W was obtained from LETs. Li et al. [11] presented a retrofit regenerative shock absorber with design, modeling, and road test. In order to harvest the energy, a rack-pinion mechanism has been used with an electromagnetic generator and vibration damper. The average power of 19 W was recorded from the shock absorber prototype with a vehicle speed of 13.33 m/s on a smooth road drive. A simple configuration and working principle of piezoelectric energy harvester to harvest the energy from the motor-bike suspension system is presented in Fig. 1. The schematic view of the model of Scissor Mechanism Piezoelectric Transducer (SMPT), attached with half motor-bike model, is demonstrated in Fig. 1(a). The main components of the SMPT are a piezo bar with edge length, height, and young's modulus, a_p, h_p, and E_p, respectively, scissor mechanism to magnify the force F, due to road roughness on the piezo bar and spring with spring constant k_s. The equivalent spring constant of the scissor mechanism and PZT bar can be given as $k_p = E_p a_p^2/(\tan\theta^2\, h_p)$, where θ is scissor angle. The total spring constant of the SMPT is $k_e = k_s k_p/(k_s + 2k_P)$. We consider the SMPT as a spring-damper suspension system, inserted between the motor bike chassis and wheel to absorb the vibration energy. Further, the wheel can be modeled as a mass with spring run on a rough road surface randomly with a moving function $z(t)$. For analysis, the half motor bike model again can be modeled as an unsprung mass m_w (mass of the wheel with spring constant k_t) and sprung mass m_b (mass of the bike with rider) connected in series by a spring (k_e) and damper (c_e) as shown in Fig. 1(b). To calculate the energy harvesting from the harvester, a mathematical model is developed and solved based on the model of the dual-mass spring-damper system, depicted in Fig. 1(b). The motor bike velocity (v) and the road roughness coefficient, $G_q(n_0)$, are the major factors affecting the electric power harvested by the harvester. The effects of the velocities on the RMS of the power harvested from the motor bike on four road classes (A, B, C, D) are shown in Fig. 2. In order to carry out the simulation, the following parameters are set: width of the PZT bar, a_p = 15 mm, thickness of the PZT bar, h_p = 15 mm, scissor angle, θ = 80°, and road roughness coefficient, $G_q(n_0)$, for classes A, B, C, and D, are 16×10^{-6} m^3/cycle, 64×10^{-6} m^3/cycle, 256×10^{-6} m^3/cycle, and 11024×10^{-6} m^3/cycle, respectively. A random Gauss white noise with zero mean was used to obtain a transverse

relative displacement of the bike and wheel. Figure 2 shows that the RMS of the electrical power increases with increasing the velocity of the motor bike, and this variation in power with velocity also depends on the road roughness coefficients, $G_q(n_0)$. The higher the value of the coefficient, the rate of increase of power with respect to velocity will be higher.

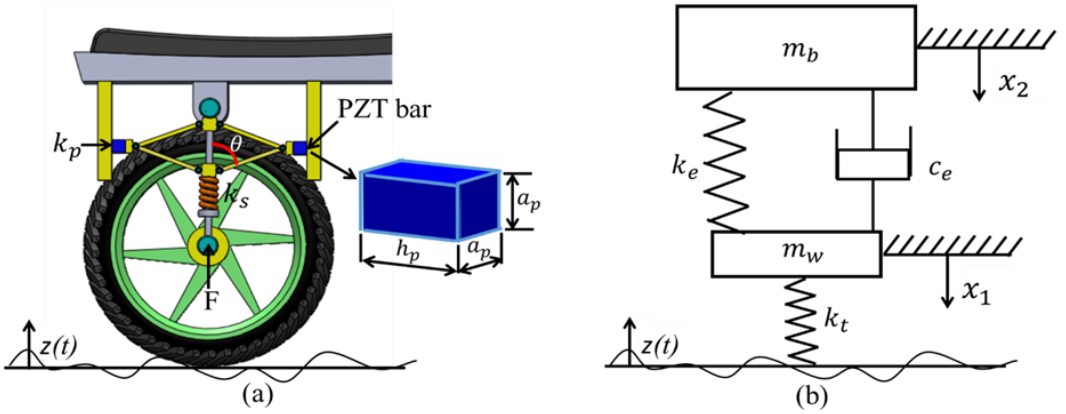

Fig. 1. (a) Half motor-bike model with scissor mechanism piezoelectric transducer, (b) schematic view of the dual-mass spring-damper system for energy harvesting

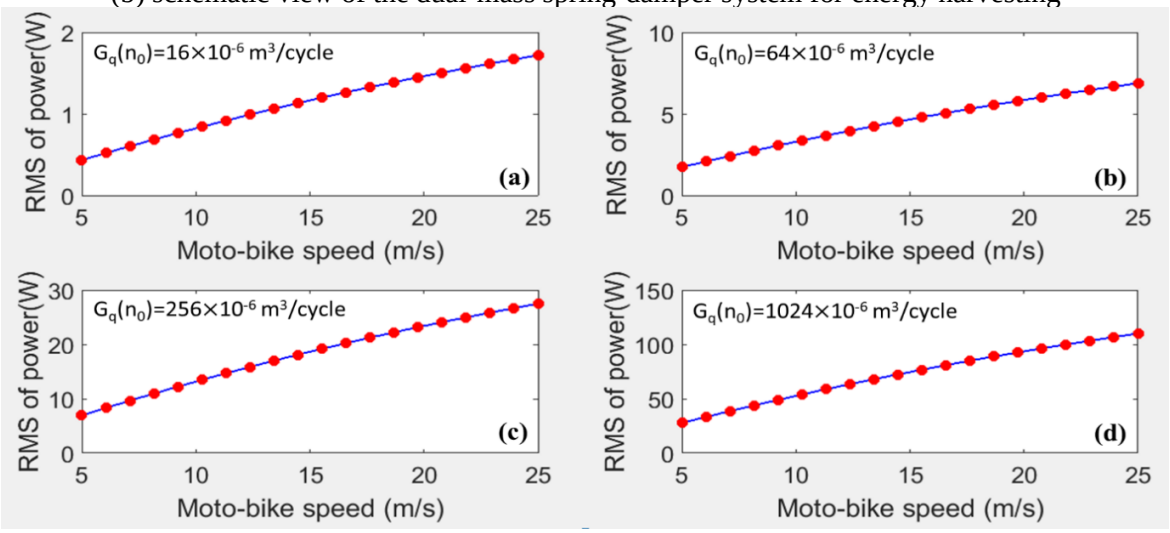

Fig. 2. Effects motor bike speed on RMS of electric power: (a) for the road of class A, (b) for the road of class B, (c) for the road of class C and (d) for the road of class D.

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The Commercialization of Public Space in Indonesian Cities: Whose Takes Benefits?

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In the contemporary era, many researchers claim that neoliberalism has privatized public space in the interests of investors when the role of government is increasingly minimal. Commercialization and commodification of public space by capitalism interests has declined the democratic meaning of urban open space. On the other hand, people's economic activities in public spaces that are increasingly mushrooming often lead to conflicts with local governments in terms of city order and cleanliness. These situations seem to explain that the commercialization of public space is something that is detrimental to society. However, through a study of the impact of the commercialization of public spaces in Indonesia from the socio-economic, cultural and political conditions, the facts show the opposite, urban communities are responding positively to economic activities in public spaces. Economic activity is seen as one of the important attractions in the public space.

Automated Control System for Operating Parameters of the Reactor for the Hydrogenation of Sulfur Compounds

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Hydrogenation of sulfur compounds is the process of converting sulfur compounds into more useful and safer compounds by adding hydrogen. This technology is widely used in the petrochemical industry for the purification of oil, gas and related products from sulfur compounds [1]. The hydrogenation process proceeds in the presence of a catalyst. Various metals such as nickel, platinum, rhodium, palladium, etc. can serve as catalysts. The process takes place at high temperatures and pressures. Hydrogen enters the reactor, where sulfur compounds and a catalyst are located. Under the action of a catalyst and high temperature, hydrogen combines with sulfur, forming more useful compounds, such as water and hydrogen sulfide [2]. Automation of the sulfur hydrogenation reactor is the process of applying technological solutions to control the hydrogenation of sulfur compounds. This approach helps to increase the efficiency and productivity of the reactor, reduce the risks of malfunctions and improve the safety and health of workers [3]. Reactor automation begins with the installation of sensors that can measure temperature, pressure, liquid level, flow rate, and other parameters. Further, these data are transmitted to the controller, which controls the system automatically so that the reactor operates with maximum efficiency and accuracy [4]. The use of the same type of means provides significant operational advantages both in terms of their configuration and maintenance and repair. There are many advantages to using an automated control system for a sour hydrogenation reactor. They include improving the efficiency and quality of production, reducing downtime and maintenance costs, reducing the risk of accidents, as well as reducing labor and cost [5].

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Multilevel Resistive Switching in Thin ZnO Films for Neuromorphic Systems

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Today the von Neumann computer architecture is becoming increasingly inefficient in tasks involving unstructured and noisy data. To solve this problem, it is necessary to eliminate the exchange of data between processor and memory, which causes increased power consumption and significantly reduces the performance of computing systems [1]. One solution to this problem is a neuromorphic architecture that mimics the biological brain, where neurons are simple computational units and synapses are local memory devices connected by communication channels [2]. Resistive random-access memory (ReRAM) is one of the most promising candidates as an element base for neuromorphic systems, because it has low switching voltages, small cell size, and can have three and more resistive states (multilevel). Resistive switching is observed in many metal-oxide systems, the most popular of which are TiO_2, HfO_2, Ta_2O_5, etc. One of the most promising materials for the ReRAM of neuromorphic systems is zinc oxide (ZnO) film, which obtained using pulse-laser deposition method. One of the tasks of manufacturing neuromorphic systems based on ZnO films is the lack of modes to study the effect of switching voltage on the multilevel resistive switching effect. Zinc oxide films were obtained on the Si/TiN substrate by pulsed laser deposition at the Pioneer 180 set-up (Neocera LCC, USA) under the following conditions: substrate temperature is 300 °C, distance between the target and the plate is 50 mm, O_2 pressure is 1 mTorr, pulse energy is 300 mJ, laser-pulse repetition rate is 10 Hz, and number of laser pulses is 23 000. Electrical measurements were made using the Keithley 4200-SCS semiconductor measurement system (Keithley, USA). The top and bottom contacts were a tungsten probe and a TiN film, respectively. Analysis of the obtained experimental results showed that increasing in switching voltage from 1 to 3 V leads to a decrease in the resistance of the ZnO film from $(2.04 \pm 0.22)\times10^3$ Ω to $(4.87 \pm 0.15)\times10^2$ Ω for the resistive state R_1; from $(6.43 \pm 0.19)\times10^3$ Ω to $(1.65 \pm 0.15)\times10^3$ Ω for the resistive state R_2; from $(1.52 \pm 0.22)\times10^4$ Ω to $(4.16 \pm 0.15)\times10^3$ Ω for the resistive state R_3; from $(3.84 \pm 0.35)\times10^4$ Ω to $(1.06 \pm 0.09)\times10^4$ Ω for the resistive state R_4; from $(9.12 \pm 0.51)\times10^4$ Ω to $(2.26 \pm 0.17)\times10^4$ Ω for the resistive state R_5. The obtained results can be used in the fabrication of energy-efficient ReRAM elements based on ZnO films for neuromorphic systems of artificial intelligence.

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Management in Legalizing Ethnographic Museum Tourism

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The Museum of Ethnographic Studies is a museum, located at the Faculty of Social and Political Sciences, Airlangga University. In improving tourism management, museums must protect, develop, utilize collections and communicate them to the public. This complete management will make the museum increasingly achieve the essence of the museum. The involvement of the local government will produce a museum according to the direction of the Minister of Education, Culture, Research and Technology of the Republic of Indonesia. However, in a different perspective, the museum is only a destination that is targeted by a group of people. This means that when someone has no interest in museums, a visit to the museum never occurs. In line with the meaning of museum management, it is an integrated effort to protect, develop, and utilize collections through policies regulating planning, implementation, and supervision for the greatest welfare of society. Therefore, the museum covers many aspects but the most important is management. In this study, survey methods including photo documentation were used. In this case the survey is a direct visit and literature review, where there is interaction between the researcher and the interpretations in it. The research was conducted in May 2023. The results for Museums of Ethnographic Studies must meet requirements such as the presence of security personnel, the expected increase in management so that the existence of the museum becomes more adequate; involvement of indigenous and tribal peoples to be able to inherit or grant what they own; and there is a continuous promotion management so that the museum becomes an attraction for the public. There is a concrete suggestion that is community participation must be achieved by the museum in order to change the paradigm that the museum is not a visit that only presents past knowledge. There is the importance of digitizing visits with ongoing human resource training.

The Important Role of Museum Management at the NU Museum as an Introduction to the Community

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As one of the largest religious organizations in Indonesia, Nahdlatul Ulama was founded on January 31, 1926 in the city of Surabaya. One of its forms is the Nahdlatul Ulama Museum in Surabaya, which presents a collection of historical objects that were used by kyai and Nadhiyin fighters during the struggle for the national movement and in the struggle for independence. There is reinforcement from the management to advance the museum, but the presentation method is not optimal [1]. Such as the lighting in the room, which is not bright enough, the arrangement of the display of the collection which merely displays without a detailed explanation to the identity of the museum, which requires an artistic touch. Management must include how to maintain a collection of existing items so that they are more optimal for visitors. Research at the Nahdlatul Ulama Museum in Surabaya was carried out by direct visits and interviews with Lilik (Museum Keeper). Even though there are visits, this does not eliminate the characteristics of legal research because researchers also use legal hermeneutics [2]. The research was conducted May – June 2023 with an entrance ticket of IDR 3,000. Results found the Nahdlatul Ulama Museum in Surabaya does not provide an iconic place inside, but the building looks green. The arrangement of items, especially paintings, reduces the meaning of items that are actually the hallmark of a museum. The availability of virtual promotions is important to provide an understanding of whether a museum is actually that what the public wants. There is a concrete suggestion, that is the existence of a discussion room on the top floor (3) must be redesigned so that it can be used as an interesting discussion event. this is important because on this floor there is a library that presents readings on law, one of which is the meaning of the state. There is more about photo spots because this is the easiest way to do promotions. Lighting with lights must be optimized so that the collections presented can be seen clearly.

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Advanced Piezo-active 2–1–2 Composites with Large Parameters for Hydroacoustic Applications

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A development in the field of piezo-active composites is associated with novel composite structures and components [1], which promote large effective electromechanical properties and other parameters for specific applications. As is known, laminar composites of the 2–2-type are characterised by a relatively simple composite structure and various possibilities to modify it.

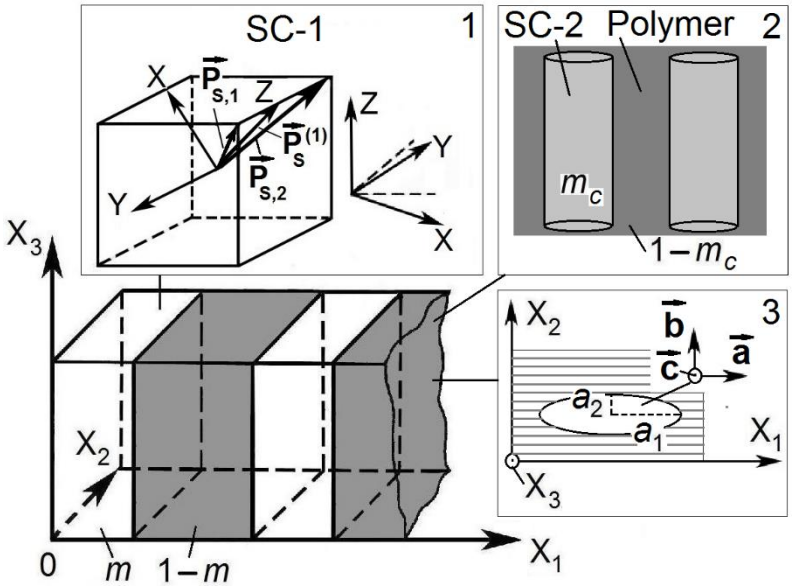

Fig. 1. Schematic of a 2–1–2 SC-1 / SC-2 / polymer composite: m and $1 - m$ are volume fractions of LFTs and LSTs, respectively; orientations of non-180° domains in SC-1 (LFT) are shown in inset 1; the SC-2 / polymer LST is shown in inset 2; m_c and $1 - m_c$ are volume fractions of SC-2 and polymer, respectively; in inset 3, the elliptic cross section of the SC-2 rod and its unit-cell vectors $\boldsymbol{a}$, $\boldsymbol{b}$ and $\boldsymbol{c}$ are shown; a_1 and a_2 are semiaxes of the SC-2 rod base.

The present study is concerned with novel 2–1–2 composites and sets of their hydrostatic parameters as follows: piezoelectric coefficients d_h^* and g_h^*, figure of merit $d_h^* g_h^*$, and electromechanical coupling factor k_h^*. The 2–1–2 composite put forward represents a system of the parallel-connected layers of two types (Fig. 1) which are periodically arranged. The layer of the first type (LFT) is a domain-engineered single crystal (SC-1) with the spontaneous polarisation vector $\boldsymbol{P}_s^{(1)} \parallel OX_3$ and main crystallographic axes X, Y and Z (inset 1 in Fig. 1). The layer of the second type (LST) is described as a system of the aligned single crystal rods (SC-2) that are periodically arranged in a polymer matrix (inset 2 in Fig. 1). Each 2–1–2 composite is based on a domain-engineered [011]-poled relaxor-ferroelectric $(1 - x)Pb(Zn_{1/3}Nb_{2/3})O_3 - xPbTiO_3$ single crystal (SC-1) at $x = 0.0475 – 0.09$). In the LST, piezoelectric $Li_2B_4O_7$ single crystal rods in the form of an elliptic cylinder are embedded in a polyethylene medium. Large values of $d_h^* > 10^{-9}$ C / N, $d_h^* g_h^* > 2 \times 10^{-10}$ Pa^{-1} and $k_h^* = 0.5 – 0.6$ in the 2–1–2 composite with $x = 0.065$ and the large aspect ratio of the rod base (e.g. $a_1 / a_2 = 100$) are achieved due to the high piezoelectric activity of the relaxor-ferroelectric component (SC-1) and due to the presence of the layers containing the

SC-2 rods with a unique anisotropy of elastic and piezoelectric properties. The studied advanced 2–1–2 composites and their hydrostatic parameters are of value in hydroacoustic applications.

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Specifics of Non-180° Domain and Heterophase Structures in Some Lead-free Ferroelectric Solid Solutions

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Ferroelectric (FE) solid solutions are of great interest due to important interconnections in the fundamental triangle "composition – structure – properties" [1]. In the last decade, an important problem to develop novel eco-friendly FE solid solutions with improved properties is under consideration. Of value are competitive lead-free materials with electrophysical properties being comparable [2] to the similar properties of the conventional lead-based FE ceramics [3]. In this context, of interest is phase coexistence in lead-free FE solid solutions with compositions near the morphotropic phase boundary because these materials are effectively used in piezotechnical and other applications. In the present report, we discuss relationships in the chain "unit-cell parameters – non-180° domain types – heterophases" [1] in perovskite-type $(Ba_{0.85}Ca_{0.15})(Ti_{0.9}Zr_{0.1})O_3$ (BCTZ) and $(1-x)(K_{0.5}Na_{0.5})(Nb_{0.97}Sb_{0.03})O_3 - x(Bi_{0.5}Ca_{0.5})ZrO_3$ [$(1-x)$KNNS – xBCZ], wherein FE tetragonal and orthorhombic phases coexist at room temperature. A model of a heterophase sample with interlayers (Fig. 1) is put forward [4] to interpret coexistence of tetragonal and orthorhombic phases in lead-free FE solid solutions. Versions of phase coexistence are analysed at variations of unit-cell parameters of BCTZ [5] and $(1-x)$KNNS – xBCZ [6] for compositions taken near morphotropic phase boundaries. Large regions of the tetragonal and orthorhombic phases are split into 90° and 120° domains, respectively. The interlayer of the orthorhombic phase is either single-domain or split into 90° domains. A complete stress relief is achieved at an elastic matching of the polydomain/single-domain or polydomain/polydomain phases. It is stated that different phase contents in $(Ba_{0.85}Ca_{0.15})(Ti_{0.9}Zr_{0.1})O_3$ powder and ceramic [5] are caused by different non-180° domain structures in the coexisting phases. The interlayer of the orthorhombic phase plays the important role in forming the phase content in solid solutions. Comparing the evaluated volume fractions of the orthorhombic phase to experimental data, we observe agreement between the evaluated and experimental results for heterophase BCTZ and $(1-x)$KNNS – xBCZ solid solutions. The results on the non-180° domain and heterophase structures can be taken into account to interpret specifics of phase coexistence in FE solid solutions, where the complete stress relief is achieved and where variations of some unit cell parameters are effective.

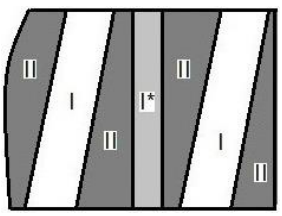

Fig. 1. Schematic of a heterophase sample [4]: I is the orthorhombic phase, I* is the interlayer of the orthorhombic phase, and II is the tetragonal phase.

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Novel Lead-free 2–2-type Composites with High Piezoelectric Sensitivity and Strong Hydrostatic Response

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A novel lead-free composite [1] with 2–1–2 connectivity and two single-crystal components (Fig. 1) is studied to demonstrate its high piezoelectric sensitivity and large hydrostatic figure of merit.

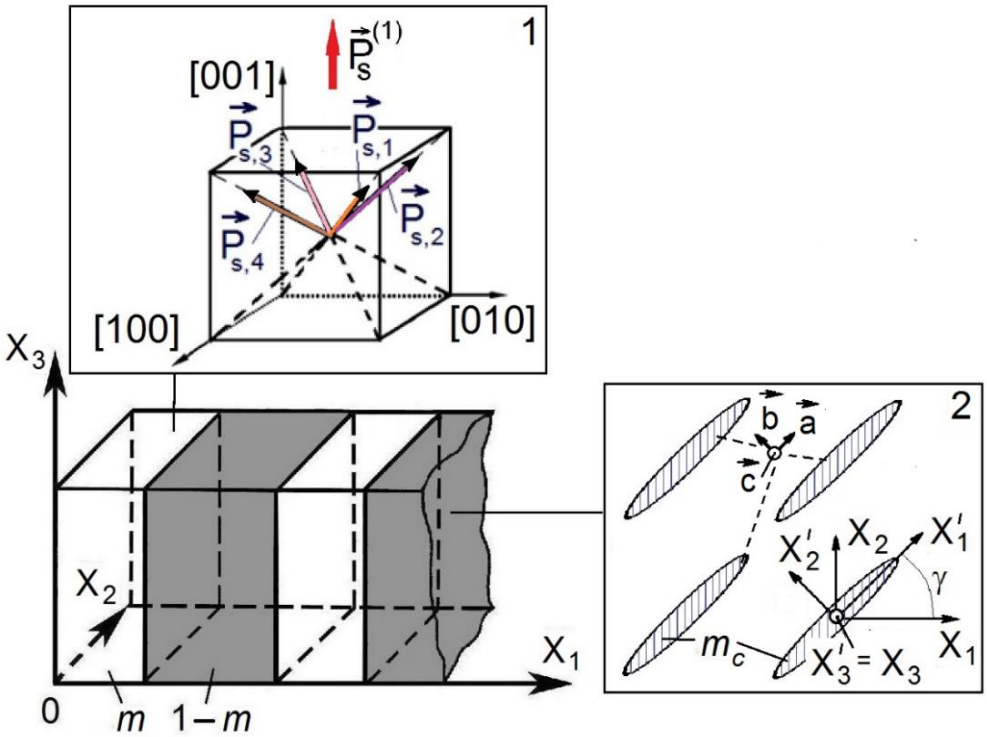

Fig. 1. Schematic of a parallel-connected 2–1–2 composite [1]; m and $1 - m$ are volume fractions of layers of the first type (ferroelectric domain-engineered single crystal, inset 1) and layers of the second type (piezoelectric single crystal / polymer, inset 2) layers, respectively. In inset 1, $\boldsymbol{P}_{s,i}$ are spontaneous polarisation vectors of non-180° domains (I = 1, 2, 3, and 4), and $\boldsymbol{P}_s^{(1)}$ is the spontaneous polarisation vector of the layer of the first type. In inset 2, m_c is the volume fraction of single crystal in the layer of the second type, $\boldsymbol{a}$, $\boldsymbol{b}$, and $\boldsymbol{c}$ are unit-cell vectors of single crystal, and γ is the rotation angle.

The first type of the composite layers represents a ferroelectric domain-engineered [001]-poled [Li, (K, Na)](Nb, Ta)O_3 single crystal (inset 1 in Fig. 1). In the second type of the composite layers, piezoelectric $Li_2B_4O_7$ single-crystal rods in the form of an elliptic cylinder at a large aspect ratio of its base are regularly aligned in a large polymer matrix. A new orientation effect [1] is associated with rotations of single-crystal rod bases in the polymer medium (inset 2 in Fig. 1). Due to these rotations in the presence of $Li_2B_4O_7$ single crystal with a unique elastic and piezoelectric anisotropy, the layers of the second type noticeable influence the piezoelectric performance and hydrostatic response of the composite. New diagrams are built for the 2–1–2 [Li, (K, Na)](Nb, Ta)O_3 / $Li_2B_4O_7$ / polyethylene composite to show ranges of rotation angles and volume fractions, which correspond to large values of the longitudinal piezoelectric coefficient $g_{33}^* > 500$ mV·m·N^{-1}, its hydrostatic analog $g_h^* > 200$ mV·m·N^{-1} and related hydrostatic figure of merit $d_h^* g_h^* > 10^{-11}$ Pa^{-1}. These effective parameters are important in piezoelectric sensor, hydroacoustic and other applications of modern lead-free composites.

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Automated System for Electrohydrogenation of Oil

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One of the most important stages of oil preparation is electrodehydrogenation. Electrodehydrogenation of oil is a process, based on the use of electrical energy to remove hydrogen sulfide from oil and gas streams. This process is an alternative oil treatment that can be more efficient and cost effective than traditional oil treatment methods. The basic principle of oil electrodehydrogenation is that electrolysis is carried out on special electrodes that are placed in the oil stream. During electrolysis, hydrogen sulfide is oxidized on the electrodes to elemental sulfur, which can be easily removed from the oil flow [1]. Automation of the technological process of oil electrohydrogenation is an important task of the modern oil and gas industry. This process is widely used to improve the quality of oil and reduce its sulfur content [2]. Before automating the process, it is necessary to analyze and model technological processes, conduct engineering study, and install monitoring and control systems [3]. It is also necessary to develop an automation project that takes into account the characteristics of a particular electrodehydrogenation unit. The main blocks of an automated control system are sensors, actuators and controllers [4]. Sensors measure process parameters, actuators control the process, and controllers make decisions, based on the data, they receive. At the stage of testing and setting up an automated control system, it is necessary to conduct test tests to identify possible problems and eliminate them. It is also necessary to train the personnel to work with the automated control system and to monitor and diagnose it [5]. Automation of the technological process of oil electrohydrogenation helps to increase production efficiency and improve product quality. It also reduces production costs and reduces environmental impact.

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Predicting Risk of Peripheral Neuropathy in Diabetic Patients Using a Deep Learning Model

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In this study, an artificial intelligence (AI) was used to establish a suitable deep learning model to predict the risk assessment of diabetic peripheral neuropathy (DPN) on fundus photographic images of patients with type II diabetes. The data collection was from 2013 to 2017, and the source of the data was the diabetes care database, established by the Department of Endocrinology and Metabolism of Kaohsiung Datong Hospital and the Affiliated Hospital of Kaohsiung Medical University. Fundus photographic images of diabetic patients were retrospectively studied. Nerve conduction velocity (NCV) methods were used to analyze and classify patients with type II diabetes who had received conventional clinical care. Images are preprocessed with adaptive histogram equalization (CLAHE) to limit contrast changes [1]. These preprocessed images were divided into training set, validation set and test set. Two other sets of rotated image data were also merged for enhancements to build predictive models with four deep learning architectures: InceptionNet, VGGNet, ResNet, and ConvMixer DPN models [2 – 4]. The filtered image data sets were shown in Fig. 1. Four deep learning architectures successfully built classification models to predict the severity of DPN. The accuracy rates of the four DPN prediction models were 0.94, 0.90, 0.97 and 0.96. The AUC values reached 0.92, 0.93, 0.95, 0.96. Specificity analyses were 1.00, 0.92, 1.00, and 0.98. Combined sensitivity values for mild and moderate to severe DPN reached 0.84, 0.90, 0.90, and 0.92. The AI-assisted diagnosis model can predict the severity of DPN, and judge whether the patient has DPN through

the retinal fundus image after ophthalmoscopy. The results show that the non-invasive DPN detection method is efficient and effective.

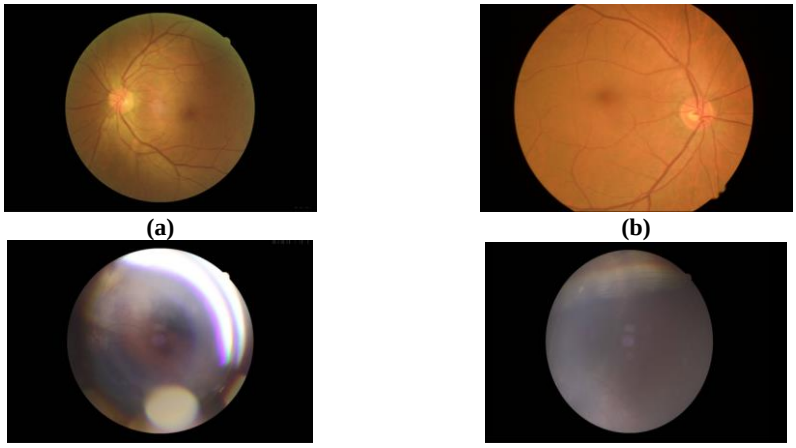

Fig. 1. Schematic diagram of retinal fundus image quality in diabetic patients: (a) retinal imaging recognized as qualified, (b) the upper and lower edges of retinal images with incomplete images, (c) in certain areas of retinal images with overexposure, (d) the too low exposures with retinal image.

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Productivity Index Calculation Using the Mundel Approach at UD. Affan

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This research was conducted at UD. Affan. UD. Affan is a production place of crispy moonlight, which is produced every day. UD Affan's vision is to produce delicious of crispy moonlight at an affordable price. This study aims to determine the productivity index at UD. Affan by obtaining productivity index results for each activity carried out at the UD. Affan. Partial productivity is the ratio of output to one of the input factors used in producing that output.

Generally, inputs are divided into four groups, namely material, energy consumption, labor, and capital. In this study, there are eleven inputs, where the inputs are labor inputs (wages and salaries), material inputs (raw materials), capital inputs, energy consumption inputs, skilled labor inputs, technology inputs, production equipment inputs, HR inputs, managerial inputs. The data collection technique used was direct interviews. From the results of the study, it was concluded that labor productivity had increased by 25 % and capital depreciation productivity had increased by 7.14 %. This was because the IP value in "Period 2 (Measured Period)" was greater than the IP value in "Period 1 (Basic Period)". The test results state that the root cause of the decline is an increase in input. The results of the different test stated that the productivity index method of the Mundel model was easier to use.

Productivity Measurement of PT Indofood Using the Objective Matrix (OMAX) Method

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This research was conducted at PT Indofood. PT. Indofood is engaged in processed food, seasonings, beverages, packaging, cooking oil, grain mills and flour sack manufacturing plants. The company started its commercial operations in 1990. The company exports its food ingredients to Australia, Asia and Europe. In the past few decades Indofood has transformed into a total food solutions company with operational activities covering all stages of the food production process, from the production and processing of raw materials to the final product available on the shelves of retail traders. The purpose of the measurement is to determine the Productivity Index at PT. Indofood with 15 periods and 7 inputs or criteria. The 15 periods are from January 2021 to March 2022, if 7 measurement criteria are inputs, including criterion 1, raw materials (input 1); criterion 2, labor (input 2); criterion 3, machinery (input 3); criterion 4, energy consumption (input 4); criterion 5, machine maintenance costs (input 5); criterion 6, equipment rental costs (input 6); criterion 7, packaging cost (input 7). The method used is the Objective Matrix (OMAX) method with the steps for calculating the performance ratios, calculating the averages and standard deviations, calculating BKA and BKB, determining the targets, determining the realistic productivity values, determining the weight values of the criteria, determining the scores from scales, determining the achievements work, and finally determining the total Productivity Index. The results of this study indicate that the Productivity Index (PI) = 0.58 for April 2021, PI = 1.22 for June 2021, PI = 0.11 for July 2021, PI = 0.01 for August 2021, PI = 0.18 for October 2021, PI = 0.14 for November 2021, PI = 0.76 for January 2022, PI = 0.99 for February 2022, PI = 0.58 for March 2022. The highest productivity value is 1.22, which was in June 2021. The lowest productivity value was 0.11 in July 2021. Criteria that did not contribute much to productivity were further improved.

Investigation of the Scratching Probe Nanolithography Regimes for the ReRAM Memristive Crossbar Structures

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The memristor crossbar can be used in various electronic devices, such as processors, artificial intelligence devices, and memory. It can provide high speed and low power consumption, making it attractive for use in various fields. Currently, memristive structures are manufactured based on titanium oxide, ferroelectric materials, magnetics, and ferromagnetics. The main advantage of using titanium oxide (TiO_2) to create memristive structures is the low values of read/write voltage and relatively high read/write speed [1]. A manufacturing memristive structures requires of accuracy and reproducibility of the obtained nanoscale structures, which can be achieved by improving lithography methods. In the process of force probe nanolithography with atomic force microscope (AFM), one of the main problems is determining the technological parameters, such as the force applied by the probe to the surface and drying time. Force varied from 3.75 to 15 μN, drying time varied from 5 to 30 minutes.

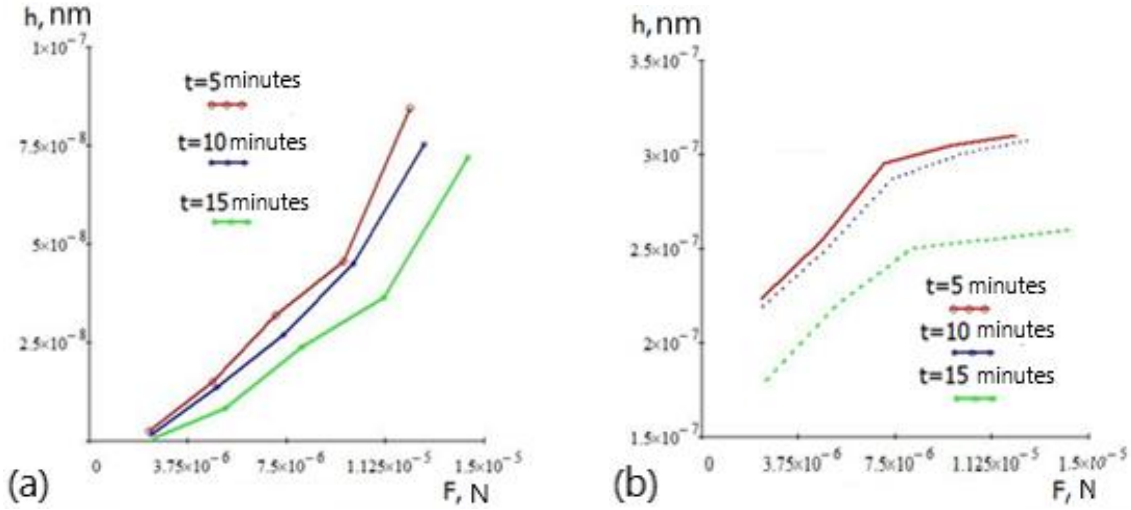

Fig. 1. Images shows the dependencies of the AFM-based force nanolithography regimes on the applied force to the surface: (a) depth of the structures; (b) width of the structures.

It is important to select the optimal level of probe force so that the substrate surface is exposed, the photoresist is completely removed from the area down to the substrate surface on the treated area to ensure contact with the substrate material in the subsequent technological operations. The obtained results (Fig. 1a, b) demonstrate that the depth of the lines is proportional to the force, applied by the probe to the surface. With increasing drying time after applying the resist, the thickness of the lines decreases slightly, and the depth also decreases, which allows for better control of the process of structure formation.

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Inverse Problems of Thermoelectroelasticity for Functionally Graded Bodies

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Pyromaterials are widely used in the creation of various diagnostic devices. Currently, to improve the operation of devices, based on the pyroelectric effect, instead of homogeneous and layered materials, functionally graded pyromaterials (FGPM) are used. FGPM are piezocomposites with variable physical properties. For the correct calculation of the stress-strain state of devices in which functionally graded pyromaterials are used, it is necessary to know the laws of the distribution of inhomogeneity. The problems of identifying the laws of inhomogeneity from some additional information about the boundary physical fields are related to coefficient inverse problems of thermoelectroelasticity, which have been studied only for a rod [1]. As the first problem, the problem of reconstructing the thermomechanical characteristics of a thickness-inhomogeneous, transversely polarized layer of 6 mm class piezoceramics is studied. The lower face of the layer is rigidly clamped, grounded and maintained at a given temperature. An unsteady thermomechanical load acts on the upper face of the layer. The displacement and temperature fields, measured on the upper face of the layer, are used as additional information. Two loading modes are considered: (i) mode of plane vibrations; (ii) regime of antiplane oscillations. To two problems, Fourier transform along the longitudinal coordinate are applied. The Fourier transforms of displacements, temperature, and load are presented as expansions in powers of the Fourier transform parameter. After simple transformations, taking into account additional information, the original problems are divided into simpler one-dimensional problems with respect to the restored functions and the averaged fields of displacements, temperature, and their moments. The solution of inverse problems is built on the base of an iterative process; at each stage of the iterative process, integral Fredholm equations of the 1st kind with a smooth kernel are solved. As a second problem, the problem of reconstructing the thermomechanical characteristics of an inhomogeneous long hollow radial polarized piezoceramic cylinder is studied. The inverse problem of thermoelectroelasticity for a cylinder is solved, based on the construction of an iterative process, similarly as for a thermoelastic pipe [2].

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Reconstruction of Rheological Properties of Functional Gradient Structures

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The problem of determining the variable rheological properties of functionally gradient beams from some additional information about displacements is considered. Vibrations of a cantilever inhomogeneous viscoelastic beam are studied in the framework of two Euler models, namely Bernoulli and Timoshenko. Fluctuations are caused by a moment, applied on the end. When solving a direct problem for modeling attenuation, the concept of complex modules is used in this report. To solve the main problem, the method of targeting was used. The solution of the inverse problem of type 1 for the Euler-Bernoulli model for various types of function, describing the change of the complex module is constructed. To solve the inverse type 2 problem, at each iteration step, the Fredholm operator equation of the 1st kind with a complex kernel is solved to determine the correction, reduced to a system of real integral equations with continuous kernels, the solution of which is based on the Tikhonov regularization method. Functions, reflecting the laws of change of long-term and instantaneous moduli, have been restored. The numerical implementation of the presented approach is carried out in the Maple package. The solution of the inverse problem in the 2nd formulation for the Tymoshenko model is constructed. An iterative process, based on the linearization method, is constructed, an integral Fredholm equation of the 1st kind with a continuous complex-valued kernel is obtained, the regularized solution of which is constructed using the Tikhonov regularization method. The results of restoring the functions of instant and long-term moduli are presented.

Investigation of the Inverse Problem for Steady Oscillations of an Inhomogeneous Piezoelectric Bodies

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The problem of steady oscillations of an inhomogeneous electroelastic body is considered. Relationships are obtained for the sensitivity of the boundary field to changes in the elastic moduli and piezomoduli. As an example, numerical results are shown for the case of steady oscillations of the FGM of an electroelastic rod, where the influence of elastic compliance and the piezoelectric modulus on the amplitude-frequency characteristic and current is analyzed. Asymptotic expansions are constructed for the amplitude-frequency characteristics of the current and displacements in problems with electrical and force loading. The formulation of the

inverse problem of the reconstruction of moduli (elastic and piezo) as functions of coordinates is formulated. As additional information, the amplitudes of oscillations on a part of the boundary in a certain frequency range and the amplitude of the current in the circuit are given. An iterative process for solving the inverse problem is described. Various methods for choosing the initial approximation are considered. General relations are obtained for finding corrections to the desired functions, which are a system of Fredholm integral equations of the first kind with smooth kernels. The necessity of using several types of loading (probing) for solving the inverse problem is substantiated. As an example, for the problem of steady oscillations of a longitudinally polarized inhomogeneous rod, the results of the simultaneous restoration of two functions are given: elastic compliance and piezoelectric modulus. Conditions are described under which the non-uniqueness of the solution of the inverse problem arises.

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Productivity Analysis of the Calcium Carbonate Production Using the Marvin E. Mundel DIPT Method "XZ"

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PT. "XZ" pays little attention to the efficiency of the use of resources (inputs) owned both in terms of materials, energy consumption, labor and maintenance of machines that support the production process, based on survey results and identification in the field. There are several basic problems underlying this research, namely: (i) *material*: it consists of limestone, which is often wet and delays in ordering; (ii) *electrical energy*: it consists of excessive use of electricity such as lights that are often not turned off during the day; (iii) *workforce*: it consists of a workforce that is less disciplined and less professional; (iv) *machine maintenance*: it consists of less optimal maintenance and old machines. Using the Marvin E. Mundel method, the data analysis techniques used include: (i) determining the deflator value, (ii) determining the constant price, (iii) calculating the total partial resource input; (iv) calculating the aggregate output, (v) partial productivity index. The last stage is the calculation of the total productivity index by comparing the total input with the total output. The analysis is carried out by calculating the productivity index by explaining the level of productivity, which then is followed by suggestions for improving productivity. The results of the productivity analysis show that the level of productivity index for the production of calcium carbonate is good. The depreciation productivity index is 105.2, material is 107.5, labor is 108, energy consumption is 102.8, maintenance is 150.8, and total productivity is 105.1.

Productivity Analysis Using Objective Matrix Method (Case Study at Auto2000 Kenjeran)

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Auto2000 Kenjeran is one of the companies, engaged in automotive and branch Auto2000. In unit entry Auto2000 branch Kenjeran achievement is still relatively low, compared with other branches in Surabaya, so it needs in increasing of productivity. How that can be done is to increase the productivity of the department of internal lines. This study aims to measure the level of productivity Auto2000 Kenjeran. Measurement method used is Objective Matrix (OMAX) method by weighting using Likert Scale. After the results obtained, it is evaluated against the criteria of productivity decline with the approach of Focus Group Discussion (FGD) and also Fishbone Diagram. Then a repair plan is performed so that increase a productivity. Productivity measurement results have shown best productivity in the amount of 572.62 in June 2016. At the same time, the worst productivity in the amount of 248.8 was in March 2016. Of achievement scores, it can be seen that the sixth criterion, namely the quality criterion with a value of 37 is lowest contributed one to the productivity index, compared to other criteria. The strategy to increase productivity is to evaluate the causes of the decreased productivity of the lowest criterion 6.

Vanadium Dioxide Films on $LiNbO_3$ Substrates for Programmed Gradient Metasurfaces

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Vanadium dioxide based metasurfaces with insulator to metal transition (MIT), triggered by heat, electric current or light are expected to boost the development of programmed THz/middle IR flat optics [1]. Recently we found new intriguing memory effect in $VO_2/TiO_2/LiNbO_3$ films, which opens up new possibilities in the design of electrically/optically controlled gradient metasurfaces [2]. In this study we further explore the MIT features as well as properties of $VO_2/TiO_2/LiNbO_3$ and $VO_2/ZnO/LiNbO_3$ composites prepared in different PLD regimes,

namely, the lattice vibrations, phase composition features in electronic structure, optical reflection properties in near IR/middle IR range. We use our recently proposed method that exploits surface acoustic waves to simultaneously accurately monitor the altered temperature and electric conductivity of the composite films during MIT. The stabilization of working point at different metastable states within the MIT phase transition curve is examined. In contrast to VO_2/TiO_2 films, which show quite abrupt MIT curve due to heating to 76 – 87 °C, the VO_2/ZnO films reveal much more gradual transition which is occurred in the range of 25 – 55 °C.

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The Computer Program for the Damage Identification in Solid Beam, Based on Solving Coefficient Inverse Problem

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The use of a mathematical model for damage identification in a real solid body is considered. The possibility of this has been studied in various cases assuming the use additional information about wave propagation in the time-space domain, frequency-space domain, and information, obtained by considering the modal analysis problem. A series of experiments with using experimental and analytical data were conducted. It was found that damage identification in the beam can be based on using its resonant frequencies, obtained by analyzing the bending vibrations. The Timoshenko beam model was used to describe these vibrations. One resonance spectrum, corresponding to the free-free boundary conditions, was used, because only it has shown agreement between the experimental data and the output from the mathematical model. In experiment, resonance frequencies were obtained by processing accelerometer data by using a signal converter and the discrete Fourier transform. These frequencies were applied in solving the coefficient inverse problems. It was assumed that the unknown damage can be modeled by coefficients of the differential equation. The program for solving the inverse problems is based on minimization of the misfit functional via the Trust-Region algorithms. The gradient and the Hessian matrix of the misfit functional are expressed through the Frechet derivative matrix. To calculate the Frechet derivative, a finite element approximation of the eigenvalue problem was used. To solve the problem that the experimental data did not correspond sufficiently the

mathematical model, the study of also resonance frequencies of an undamaged beam was performed. This study assumed that the damage can be identified by analyzing the difference between the solutions of the inverse problems for the damaged and the undamaged beams. It was shown that the developed computer program can determine the location of test cracks with sufficient accuracy, and it takes into account the non-uniqueness of the solution.

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Energy Storage Devices Based on Solid Solutions of Barium Titanate-Zirconate and Silver Niobate

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The search for highly efficient and environmentally friendly materials for energy storing is one of the urgent problems of our time. Dielectric capacitors play an important role in this matter, demonstrating high energy density, ultra-long service life, safety, and reliability. To create high-performance capacitors, dielectric media are increasingly used that exhibit the properties of antiferroelectrics, since namely in them, it is possible to achieve a higher density of stored energy and higher effective power than in conventional linear dielectrics [1 – 3]. Thus, the main goal of the work was to search for new dielectric media for highly efficient energy storage. Solid solutions (SSs) $(1 - y)BaTi_{1-x}Zr_xO_3 - yAgNbO_3$, where x = 0.15, 0.2, y = 0, 0.03, 0.06, 0.09 were selected as objects of study. System $BaTi_{1-x}Zr_xO_3$ (BZT) was obtained by two-steps synthesis at T_{sint} = 1733 K, t = 2h [4, 5]. $AgNbO_3$ was obtained by one-step synthesis at T_{sint} = 1173 K, t = 5h. System $(1 - y)BaTi_{1-x}Zr_xO_3 - yAgNbO_3$ was obtained by two-steps synthesis at T_{sint} = 1643 K. Before sintering, all SSs were mechanically activated for 20 min. The phase composition and completeness of the synthesis were controlled using X-ray diffraction at the wavelength of CoKα, using a DRON-3 diffractometer. At each stage of the technological process, a step-by-step optimization of the conditions for the formation of SS was carried out. The density of the samples was determined by hydrostatic weighing in *n*-octane. Dielectric hysteresis loops were obtained at room temperature, a frequency of 50 Hz and an electric field of up to 2500 V. The dielectric constant was investigated in a wide range of frequencies of 10 – 10^6 Hz and temperatures of 80 – 750 K. It is shown that the SSs, obtained by this method have a high density, show signs of coexistence of several phases with similar parameters of the unit cell. On the dependences of the dielectric constant, widely blurred maxima are observed, the behavior of which may indicate the formation of a dipole-glass state in a certain temperature range. The low concentrations of $AgNbO_3$ leads to a significant change in the shape of the dielectric hysteresis loops, compared to BZT. At low concentrations of $AgNbO_3$, optimal conditions for energy storage are achieved, a further increase in the concentration leads to a decrease in efficiency and effective stored energy. It is advisable to use the obtained data to optimize the production processes of multicomponent lead-free ceramics, based on BZT, and to obtain materials, in which different types of ferro-ordering coexist.

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Effect of Calcination Temperature on the Phase Composition of Titanium Dioxide Based Materials Modified with Sn^{4+} and F^{-}

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Titanium dioxide is one of the most widespread semiconductor nanomaterials. Anatase and rutile are the most stable modifications of titanium dioxide, rutile is thermodynamically more stable, and the anatase phase has higher photocatalytic properties. Depending on the phase composition, the functional properties of the obtained nanomaterials are determined. To improve the materials properties, various methods are used, among which the most promising at present is co-doping with metals and non-metals, which also affects the phase composition of materials. The aim of this work was to study the calcination temperature effect on the phase composition of titanium dioxide-based materials, modified with 5 mol.% of Sn^{4+} and 5 mol.% F^{-}. The synthesis of powdered nanomaterials was carried out by the sol-gel method according to the previously described method [1]. Titanium (IV) hydroxide was precipitated simultaneously with tin (IV) hydroxide, fluoride ions were added directly before drying. The final temperature treatment of powder materials was carried out at a temperature of 500, 600 or 700 °C for two hours. The synthesized materials were investigated by X-ray powder diffraction analysis (diffractometer Thermo ARL, Switzerland in CuK□ radiation). It was shown that the samples, calcined at the temperature of 500 °C, are crystallized in the anatase phase, the materials, calcined at the temperature of 600 °C, contain a mixture of anatase and rutile phases, the materials, calcined at the temperature of 700 °C, are crystallized in the rutile phase. Since tin dioxide is characterized by the rutile structure, such transition to rutile phase in titanium dioxide may be due to a similar type of phases at high calcination temperatures. It was also found that an increase in the synthesis temperature leads to an increase in the intensity of peaks and, as consequence an increase in the materials crystallinity. Particles size was calculated from the coherent scattering regions according to the Scherrer equation for all materials. It was shown

that particle size was 15 – 30 nm, depending on the calcination temperature. Thus, powdered nanomaterials, based on titanium dioxide co-doped with Sn^{4+} and F^{-} ions, were synthesized. It was found that an increase in the synthesis temperature leads to an increase in particles size. At the calcination temperature up to 500 °C, the synthesized materials have an anatase structure. At the calcination temperature above 700 °C, materials crystallized in the rutile phase.

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Modeling the Effect of Amplitude-dependent Storage of Electrical and Magnetic Energy in Analog and Digital Integrated Circuits of Gigahertz and Terahertz Wave Ranges

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Modern semiconductor microwave analog and digital high-speed integrated circuits are a single combination of long metal wires, *p-n* junctions and circulation areas contacts of convection and induced alternating currents in an "isolating" dielectric material. Any electronic device with electrostatic control is primarily a storage of electrical energy with an optimized coefficient of coupling with a common electromagnetic field. When modeling an integrated circuit, the dependence of energy (reactive) properties of an integrated circuit on an "open" system of power conductors is usually not taken into account. However, this is important for the reliability of the circuit model since the system of power conductors form feedback channels with directional propagation of electromagnetic waves inside and around the conductors. Additionally, it should be taken into account that in coherent signal regular transmission lines in radiating circuits it is impossible to specify multimode sections that store electrical and magnetic energy depending on the properties of adjacent electronic devices [1, 2]. The aim of the work is to study phenomenologically the regularity of controlled redistribution of reactive power by a set of electronic devices, taking into account the multimode resonance of currents and voltages in long lines. Modelling the signal transmission by galvanic and wireless connections of an integrated circuit is carried out in a recursive way in a monochromatic approximation. In this case, methods of theoretical electrical and radio engineering are used and the effect of energy regeneration as a result of thermal fluctuations of direct current and supply voltage is taken into account. However, when modeling integrated circuits, represented as an electronic wave circuit, it is not correct to use the algorithm for describing circuit sections only by idealized active and passive nonlinear elements operating in the reflection and transmission mode. Therefore, the symbolic analysis of the signal composition of discrete electronic devices is based on a lumped-elements scheme of parallel-series connection of non-reciprocal quadripoles. During the theoretical study of electromagnetic oscillations regeneration in an

electronic wave circuit model, the following were determined: (i) system natural resonant frequencies; (ii) amplitude and frequency derivatives for the input impedance components of the circuit. These parameters allow finding the stability criteria for microwave oscillatory processes that lead to self-excitation of undamped fluctuations of electromagnetic fields in an integrated circuit. The theoretical study of the effects that appear when controlling the electrical and magnetic energy accumulation by integrated circuits makes it possible to optimize the signal intensity and reduce the power consumption of power supplies for radiating electronic devices.

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Modeling the Microwave Electronic Micro- and Nanosystems in a Common Electromagnetic Field

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To design multilevel connections of microwave integrated circuits, it is initially necessary to use the methods of equivalent circuits and complex amplitudes for correct formalizing energy processes in a one-dimensional structure containing discrete diodes and (or) transistors connected by supply conductors. The next stage is a phenomenological study of the boundary conditions for the theoretical study of the electronic devices forming "open" set. The boundary conditions depend on the used material parameters, multimode resonance and the phenomenon of electromagnetic wave diffraction. To study circuits, the theory of an electronic wave circuit is used without applying the principle of superposition. The fact is that when developing any microwave integrated circuit, there is no possibility to use the numerical analysis for describing the coherent response of electronic devices with a current-voltage characteristic that do not correspond to Ohm's law [1, 2]. At the same time, at present, understandable and adequate algorithms for engineering calculation of the stable energy state of microwave electronic micro- and nanosystems for any purpose have not been developed. The purpose of the report is to present the mathematical modeling and symbolic analysis for a collective impact in electronic device and metal wires systems, necessary for constructive synthesis of multilevel galvanic and wireless connections in integrated circuits using the non-autonomous blocks method. In this report, idealized graphical and analytical operators of the electronic wave circuit theory are obtained. The electronic wave circuit is presented as a segment of a transmission line shunted at both ends with a "payload" and negatrons – non-linear elements with negative conductivity.

The amplitude-dependent transformation of the current-voltage characteristic of electronic devices in a non-uniform electromagnetic field is theoretically studied in the harmonic approximation without taking into account distributed losses and dispersion in a long connection, energy properties of a resistive-negatron two-terminal network. It is shown that the real part of the input impedance of the electronic wave circuit and, accordingly, the boundary conditions in the integrated circuit are determined by the instantaneous sum of DC and AC and voltage. The sum of DC and AC and voltage depends on the coordinate of the observation point and the intensity of the impact, the type and power of the circuit power source. This work presents the results for an engineering studying the power inertial composition of the microwave signals, which is necessary to optimize the position of the "working" point on the current-voltage characteristic of a separate nonlinear element in order to minimize power consumption and heating of multilayer structures of analog and digital integrated circuits in the gigahertz and terahertz ranges.

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Multi-parameter Assessment of Wear Resistance of Antifriction Ion-plasma Coatings Deposited on a Cemented Steel Substrate

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The paper solves the problem of multiparametric optimization of vacuum ion-plasma coatings based on the use of a database formed by the authors over a number of years of experimental and applied work in the field of improving the antifriction properties of machine-building units and assemblies. As an object of study, three types of single-layer vacuum ion-plasma coatings with a thickness of 1.0 – 2.5 μm, obtained by the arc method of cathodic evaporation, are considered. The coatings of the two nitride systems TiAlN and CrAlSiN had different microstructures: TiAlN was single-phase, and CrAlSiN was heterophase. The carbon diamond-like coating (DLC) is also a single layer, but it is characterized by a gradient distribution of the electronic configurations of carbon sp^3 and sp^2 in depth. Coatings were applied to a substrate made in the form of slab specimens of $_{12}Cr_2Ni_4$ steel, subjected to carburizing followed by quenching and low tempering. Wear-resistant cemented surface layers of steel products, as well as nitrided layers, are widely used in mechanical engineering as a contact surface in loaded friction units. Therefore, when conducting a comparative analysis, the mechanical and tribological characteristics of the cemented surface of the samples (without coatings) were used as a reference and were considered in the optimization process along with coatings. The method of multi-parameter optimization of coatings, including the cemented layer of the substrate, provided for an integral assessment of each material for a set of properties by constructing radial

(beam) diagrams for eight properties that combine 4 physical-mechanical and 3 tribological characteristics, as well as the coating thickness parameter. Thus, 8-beam diagrams were constructed, where they were used as rays of the metric axes: hardness H, modulus of elasticity E, ratio H/E, characterizing the resistance to elastic deformation, plasticity index H^3/E^2, characterizing the resistance to plastic deformation, coefficient of friction μ, wear of coating J, wear of counterbody J_K, thickness h of coatings and carburized layer. Comparative multiparameter integral assessment of coatings was carried out by calculating the areas of polygons, corresponding to each material in the radial diagram. The results of the analysis showed a stable pattern: according to the complex of eight specified parameters, all coatings significantly exceed the reference cemented layer. The CrAlSiN coating has the highest integral index of properties. As a promising conclusion, it is noted that in order to increase the performance of loaded steel tribo-couplings, it is highly expedient to synthesize combined coatings, including systems of various nature. In particular, a combined coating is currently undergoing industrial testing, including a wear-resistant CrAlSiN nitride layer of 1.0 – 1.5 μm thickness, deposited on the substrate and an outer DLC carbon layer, which, in the absence of lubrication, significantly reduces the friction coefficient.

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Using Quantum Dot Structure and Suitable Material for Increasing Propagation Length of Surface Plasmon Polariton

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Hybrid surface plasmon polariton waveguides (HSPPWGs) are used to transmit and manipulate nanoscale optical signals as plasmonic waveguides. This increases optical communication network bandwidth and data transmission rates and due to their unique properties, HSPPWG are versatile photonics and integrated optics platforms. In order to achieve many positive results, the study used several proposed models and simulated them using the COMSOL Multiphysics software with MATLAB. The gain in the quantum dots significantly improved the results with a choice of certain semiconductor active material. The main is to reach more than ten times the original length (without material gain) and have good quantum confinement according to the FoM test and Γ-confinement factor which caused a jump in the calculated propagation length of the hybrid waveguide.

OMAX Method for Productivity Measurement: A Case Study on Pudding Silky Company

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The OMAX (Objective Matrix) method is a performance measurement approach that integrates interconnected productivity criteria into a unified framework. Productivity is measured by comparing the output (process results) to the input (resources utilized). Developed by James L. Riggs from Oregon State University, the OMAX method offers several advantages, including ease of application, relevance to projects and service functions with challenging productivity measurement, simplicity, ease of understanding, and no requirement for specialized expertise. This study focuses on applying the OMAX method to measure productivity at Pudding Silky Company. The objective of the measurement is to determine the Productivity Index. The measurement process involves several stages, including defining measurement objectives, identifying measurement criteria and data, calculating performance ratios for each criterion, determining average and standard deviation, setting upper and lower control limits, establishing productivity targets, assessing realistic productivity values, assigning weights to criteria, scoring based on the scale and weights, evaluating work achievements, and calculating the overall Productivity Index. For the case study, seven measurement criteria are considered as inputs: raw materials, labor, machinery, energy consumption, direct labor costs, depreciation, and maintenance. Input and output data from January 2019 to March 2020 have been collected. By applying the OMAX method, the study aims to provide insights into the productivity performance of Pudding Silky Company and facilitate informed decision-making regarding productivity improvement strategies.

Optimizing Productivity in Silky Pudding Industry: A Mundel Approach to Effective Management

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The research focuses on enhancing productivity in the rapidly growing silky pudding industry through the application of the Mundel approach. Improved productivity is crucial for companies to maintain competitiveness in the market. By adopting the Mundel approach, the Silky pudding company can address productivity challenges and improve its operations. Various productivity indices were evaluated, providing insights into the company's performance. Recommendations include optimizing workforce utilization, improving raw material management, and achieving cost efficiency. Addressing specific concerns, such as the decrease in the book value of capital and the increase in delivery cost, is essential for sustainable growth. Implementing the Mundel

approach can help the company achieve optimal productivity levels and strengthen its market position. The research provides valuable insights and recommendations to support informed decision-making and productivity improvement efforts. This research utilized a qualitative approach, including direct observation, interviews with company management, and analysis of relevant documents, to investigate the application of the Mundel approach in managing productivity at the Silky pudding company. Direct observation provided firsthand insights into daily operations, while interviews gathered perspectives on productivity and identified improvement strategies. Analysis of documents supplemented the qualitative data. The Mundel approach was applied through problem identification, strategic planning, action implementation, and result evaluation. The research, aimed to gain insights into current productivity, identified areas for improvement, and developed recommendations for enhancing productivity at the Silky pudding company. The analysis of productivity performance at the Silky pudding company using the Mundel approach revealed significant improvements in labor efficiency, cost management, and capital asset utilization. However, there were concerns regarding the decrease in the book value of capital and increases in certain operational costs. The findings emphasize the need for efficient workforce utilization, optimal raw material management, and cost efficiency. By addressing these areas and implementing the strategic recommendations, the company can enhance its productivity, strengthen its market position, and meet customer demands effectively. In conclusion, the application of the Mundel approach in managing productivity at the Silky pudding company has provided valuable insights and recommendations for enhancing its performance. The analysis of various productivity indices highlighted areas of improvement, such as labor efficiency, cost management, and capital asset utilization. To achieve optimal productivity levels, the company should focus on efficient workforce utilization, optimal raw material management, and cost efficiency. Attention should be given to addressing the decrease in the book value of capital and optimizing operational costs, particularly handling, packaging, and delivery costs. By implementing the recommended strategies, the Silky pudding company can strengthen its competitiveness, achieve sustainable growth, and position itself as a leader in the market. This research contributes to informed decision-making and provides a roadmap for productivity improvement in the pudding industry.

Neutral-Color Perovskite Solar Cells Fabricated Through a Multilayer Film Design

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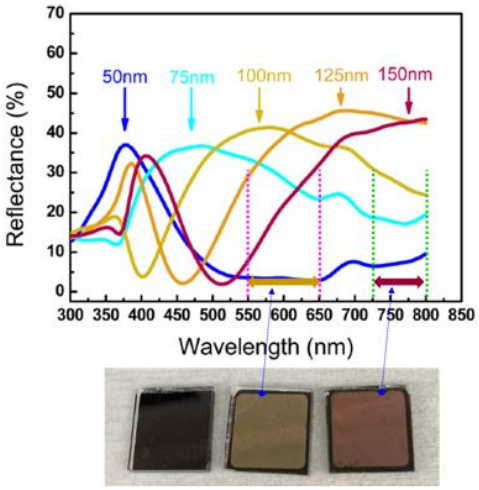
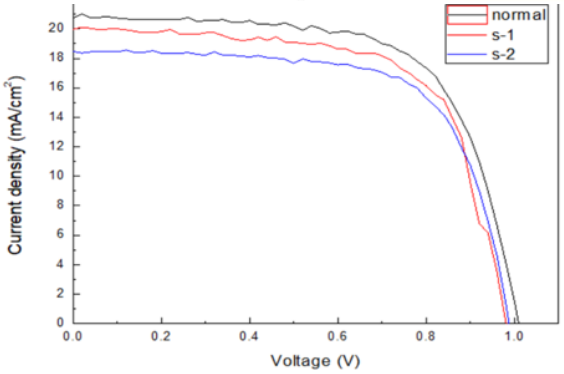
Buildings account for 40 % of the global energy use. Consequently, the mass realization of net-zero-energy buildings (NZEBs) is the top priority for urban developers. Therefore, the

integration of photovoltaics (BIPV) in billions of windows is a top challenge that seems to be realized. Neutral-colored semitransparent solar cells are commercially desired to integrate solar cells into the windows and cladding of buildings and automotive applications. A neutral color of semitransparent perovskite thin film solar cells is illustrated by using a multilayer film design.



The study successfully used ACR technology to develop neutral (warm) light yellow and orange-red stained-glass technologies respectively.



- Light yellow sample (s-1) and orange red sample (s-2) were irradiated by AM1.5 Sun, and their photoelectric conversion efficiency (PCE) was as high as 12.3%.
- The current loss is only between 4.4% and 11%, which shows that ACR technology still has high absorption of visible light incident on perovskite, and a small part of light reflection shows a colorful state

The multilayer film consists of gold (Au) and indium tin oxide (ITO), which serves as an adjusted color reflection (ACR) multilayer film. The color can be adjusted with wide range from dark blue to blue-red colors when the ITO thickness increases from 50 to 150 nm. The color adjusted by the ACR multilayer film is in good agreement with the reflectance response of the multilayer. The study successfully used ACR technology to develop neutral (warm) light yellow and orange-red stained-glass technologies, respectively. Compared with opaque perovskite solar cells, the conversion efficiency of perovskite solar cells in warm colors can still maintain > 12%. This may open the opportunity to fabricate various color patterns or pictures on perovskite thin film solar cells for advertisement, decoration, and other purposes.

Acknowledgement. The financial support provided by Bureau of Energy (Grant No. 112-S0102) is gratefully acknowledged.

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Analysis of Constitutive Relations for Problems of Large Deformations of the Shells of Revolution

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To solve the problems of large changes in the shape of the shells of revolution, it is necessary to choose the appropriate mathematical models (equations). The equations should take into account the large displacements and rotation angles of the shell elements, and also do not assume a small relative elongation, compared to one. A suitable starting base for the analysis of axisymmetric deformation of shells at large displacements and rotation angles are the equations that were developed by E. Reissner in 1949, 1950, 1963, 1969 years. These equations were derived for small elongations and elasticity ratios of the type of Hooke's law. Generalization of these equations to large elongations is carried out by methods of nonlinear elasticity theory and presented in [1]. The change in the metric of the coordinate surface of the deformed shell and the change in the thickness of the shell during deformation are taken into account. The equations of equilibrium in forces and moments are derived as consequence of the principle of possible Lagrange displacements. Also, for the closure of the system of equations of boundary value problems, an important issue is the choice of physical relations linking internal forces and moments with the components of deformations. Variants of physical relations for the problems of large nonlinear deformations of axisymmetric shells of the Davis – Nadai (DN) type and semilinear (SL) material are derived from the relations for the continuum. In the ratios DN and SL, elastic moduli are replaced by secant and the usual components of deformations are replaced by logarithmic ones. For the description of the properties of a material in the deformation theory of plasticity, the physical dependence between the intensity of stresses and the intensity of true (logarithmic) deformations is widely used. To specify the type of this dependence, a power approximation is used, the parameters of which are two constants. The latter are determined from the conditions of passage of the approximating curve through the points of the conditional yield strength and tensile strength. These points can be easily found in reference books. The hypotheses about the incompressibility of the material, the Kirchhoff hypotheses about normal stresses and the expansion of the plasticity modulus in a power series along the transverse coordinate are applied. On this base, two-dimensional analogues are derived. The adequacy of the DN ratios for metals has been previously verified. The SL ratios were practically not used. At the same time, they have a slightly simpler appearance than the DN. It is of interest to analyze in comparison with the DN and check on some problems of modeling the plastic molding of shells of revolution. Analysis of the formulae for internal forces and moments shows that the internal force factors of the SL create a higher resistance than the DN. Accordingly, in the problem of extracting a dome from a round plate (such as a flapping membrane), the molding pressure of the SL turns out to be ten percent higher with the same geometric parameters. The DN ratios were tested on this problem and gave a good match with the experiment. The use of the SL model gives a noticeable discrepancy. Therefore, for the tasks of forming metal shells of rotation, it is advisable to apply the DN model.

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Hydrophones and Knock Sensors Based on Environmentally Friendly Element Base

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The modern market of solid-state technology is replete with many expensive devices and sensor equipment for various purposes based on piezoelectric ceramics and commercially mastered by world practice. One of the disadvantages of such systems is their low noise immunity and sensitivity, as well as the presence of extremely toxic lead-containing multicomponent media in the active elements. Not only such an element base significantly increases the cost of devices, their manufacture associates with environmental unsafety of technological processes due to the lead compounds are poisons with a cumulative effect, heading the list of priority, especially harmful substances of the first hazard class. In connection with the foregoing, as well as following the requirements of the Legislative Initiatives of the European Parliament, the Technical Regulations of the EAEU, the National Security Strategy of the Russian Federation "On Restricting the Use of Hazardous Substances in Electrical and Radio Electronics Products", it seems relevant and significant to develop such a design of selected devices, namely hydrophones, designed to receive sound and ultrasound under water, and knock sensors, providing the most complete and efficient combustion of the fuel-air mixture in the cylinders of internal combustion engines, which would be devoid of these disadvantages, which was the purpose of this study. Despite the increased interest shown by researchers and developers of electronic equipment in non-toxic materials science [1 – 5], environmentally friendly compositions that would have the necessary parameters have not yet been developed. In the present work, we fill this gap by posing (and solving) the problem of creating ferro-piezoceramic materials, based on alkali metal niobates that meet the requirements put forward earlier. The report presents the results of research and development of designs of detonation sensors and hydrophones, in which lead-free environmentally friendly materials, based on media with the participation of alkali metal niobates, are used as the basis of active elements. This made it possible to achieve, in addition to non-toxic production, an improvement in characteristics, including noise immunity of the developed sensor equipment and hydrophone devices.

Acknowledgement. The study was carried out with the financial support of the Ministry of Science and Higher Education of the Russian Federation (State task in the field of scientific activity in 2023). Project No. FENW-2023-0010/(GZ0110/23-11-IF).

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Museum Management Used by the W.R. Soepratman Museum

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The W.R. Soepratman Museum is a Historical House museum, dedicated to the national hero W.R. Soepratman, is located in Surabaya. This museum is a place of learning especially for younger generations, with a vision of becoming one of the historical tourist destinations in Indonesia, also with additional aims such as showing appreciation for W.R. Soepratman and his role throughout Indonesia's struggles. Recently, a study was done where it utilized survey and documentation methods to create a documentary that shows cases the museum's history and management. The results highlight the need for additional requirements, including the presence of security personnel, to enhance the museum's security and overall quality. The museum is an institution that works, protects, develops, utilizing collections, and communicating it to the community.The museum with this aim to commemorate, perpetuate, and knows the history of good in the form of objects, stories, buildings ever. The museum is a place to collect the historic objects, trying to get closer to the community. Through museum, the community, especially students, learned about the history of each region. The museum manages the evidence of materials of cultural and natural materials and its natural materials that have essential value for history, science, education, religion, culture, technology, and tourism to be communicated and exhibited to the general public through permanent, temporary, and travel exhibitions. Most museums offer programs and activities that reach all visitors, including adults, children, the whole family, and other levels of profession. The program for general consists of lectures or training with teachers, experts, with movies, music or dance shows, and demonstrations with technology. Similarly, the visit of the museum of students can clarify their imagination on the history lessons from the teacher at school, as it is helped attention to diorama, photographs, collections and their explanation. By visiting the museum of one will learn and add his knowledge especially with the objects collected in the museum. In conclusion, the museum for a nation is important. The civilization of a nation can be seen from or through the museums it has. A foreign who comes in an area does not need to browse the whole area to get to know and see culture or history. With the good field museums desire to understand the civilization of the region has been partially missed. The benefits of museum for indigenous population is a mirror of his ancestors. Moreover, the museum serves as a cultural exchange, bridging the gap between different societies and encourages empathy and understanding. By displaying the traditions, habits, and trust from diverse civilizations, the museum promotes dialogue and facilitates deeper appreciation for cultural diversity.

Study of Elliptical Coupling of Transmission Shaft and Pinion in NP-720 Pump Drive

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In present, for many new projects and projects involving the modernization of oil and gas production facilities, there is a great demand for pumping equipment that is fully compliant with existing requirements and challenges. Plunger pumps are reliable, robust, high-output, energy-efficient, compact units, widely used in industries requiring high pressure. High-pressure pumps, operate in difficult conditions with abrasive, corrosive and other aggressive liquid media. For this reason, the design of these pumps is constantly being improved [1]. The primary objective of the study is to reduce the mass and volume characteristics of the high-pressure plunger pump NP-720 by improving the design of the drive unit. On the chosen direction of research, many information sources were considered and analysis of existing high-pressure pumps for oil and gas well service in the market was carried out. Due to it was concluded that to solve the problem of pump metal intensity and its dimensions it is necessary to integrate a gearbox directly into the drive part of NP-720 pump. To accomplish this task, it was decided to integrate the transmission shaft into the pump casing. Based on the results of the meshing geometry calculations and the overall dimensions of the pump casing, the transmission shaft-pinion was designed, the main crankshaft was improved by adding gear slots and the pump casing was improved. A detailed analysis of the transmission shaft showed that the pinion shaft has a set of significant disadvantages, such as high cost and poor maintainability [2]. Due to, it was decided to carry out a study on replacing the pinion shaft with a shaft-hub connection with an oval bore to fit the shaft. The entire study can be divided into three stages. In the first step, the axle spacing was determined as a function of the permissible contact stress and the permissible wheel width factor. The selection criterion was the condition that the center-to-center spacing must be maximum but cannot exceed the maximum permissible wheel width. In the second stage, we calculated the geometric parameters of the gearing. The result of this stage of the study were the values of the number of teeth of the gear, the module and the angle of inclination of the teeth, at which the value of the diameter of the cavities of the gear was the maximum allowable. However, interaxial distance, obtained at these values of arguments, did not exceed the maximum allowable. In the third step, the diameter of the round shaft under the pinion was found from the torsional strength condition in dependence on the allowable torsional stress τ of the various materials. Further, the dependence of the minimum thickness of the pinion ring on the modulus was found. Substituting this dependence into MS Exel package, a plot was constructed and a function was found that corresponded as closely as possible to the required one. Using this function, the minimum thickness of the pinion ring was found in PTC Mathcad package at a given modulus. Knowing the diameter of the pinion bore to fit on the shaft and minimum thickness of the pinion ring, a distance Δ (mm) was found, depending on the material, within which the larger diameter of the oval can be changed at a given load value. A parametric model of the oval shaft-oval sleeve connection was created in Compass 3D package. By specifying different material for the shaft and by varying the value of Δ up to the maximum, a series of experiments were carried out in the APM FEM application. The results of the experiments were the maximum contact stresses and displacement values at the oval connection.

The data, obtained by the experiments, were presented in the form of plots. From these plots, it can be concluded that the contact stresses and displacements decrease as the parameter Δ increases, that is, when the ellipse of the pinion bore increases. This dependence was observed with different materials.

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Structure Phase State of Nanostructured $YbMn_{1-x}Fe_xO_3$

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Nanostructured $YbMn_{1-x}Fe_xO_3$ is a type of complex oxide material that has been attracting significant interest in the field of materials science and engineering due to its unique physical properties. The nanostructuring of $YbMn_{1-x}Fe_xO_3$ is a process that involves reducing the size of the particles to the nanoscale. This can be achieved using a variety of techniques such as sol-gel synthesis, hydrothermal synthesis, and thermal decomposition. The resulting nanostructured material has a high surface area to volume ratio, which enhances its reactivity and unique properties. In this work, the complex oxides were subjected to mechanical activation to achieve their nanostructuring using Bridgman anvils. This process involves applying high pressure and shear forces to the material, resulting in the creation of a large number of defects such as dislocations, grain boundaries, and vacancies. These defects facilitate the formation of nanoscale particles, resulting in the nanostructuring of the complex oxides. The concentration of Fe^{3+} dopant was varied from 0.0 to 1.0 with increments of 0.1, and the unit cell parameters of the H-hexagonal (*P6₃cm*) and O-orthorhombic (*Pnma*) phases were analyzed using X-ray diffraction. The study found a morphotropic region (MR) characterized by the coexistence of H- and O-phases in the range of $x = 0.6 – 0.8$ in both the starting and mechanically activated samples (see Fig. 1(a)). Mechanical activation at 1 GPa did not change the symmetry of the samples. At $x = 0.5$, a minimum value of all bond lengths in the H-phase was observed, and at $x = 0.8$, a bond length minimum of the YbO_8 dodecahedra of the O-phase was observed. The sharp line of the IR absorption spectra at 10285 cm^{-1} is characteristic for the $^2F_{7/2} \rightarrow {}^2F_{5/2}$ transition of Yb^{3+} in hexagonal structure of $YbMnO_3$, and this absorption line shifts towards lower wave number with increasing doping ratio.

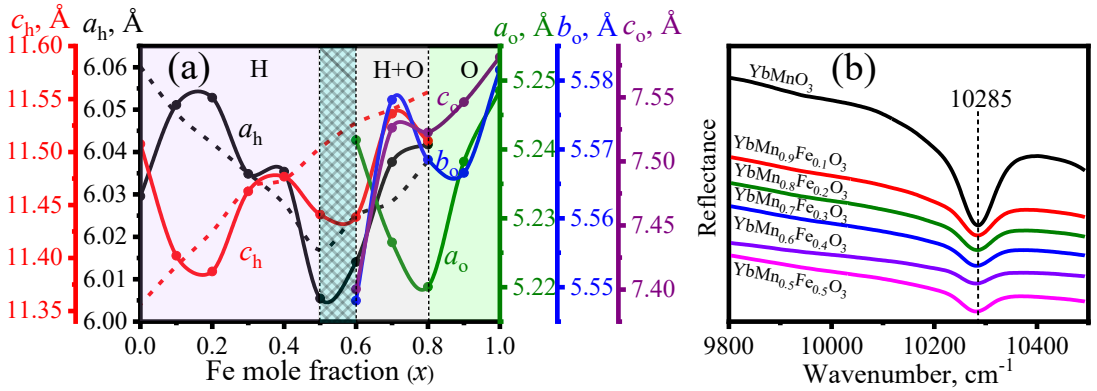

Fig. 1. Dependence of the lattice parameters of the H- and O-phases of starting (dashed lines) and mechanically activated (solid lines) samples (a), the $^2F_{7/2} \rightarrow {}^2F_{5/2}$ transition of Yb^{3+} in hexagonal structure of $YbMn_{1-x}Fe_xO_3$ (b).

Investigation of the Neodymium Barium Ferroniobate Films Optical Properties at High Temperatures

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Materials crystallizing in the structure of tungsten bronze are of great interest for optical and dielectric applications [1, 2]. It is known that the introduction of neodymium cations in ceramics $Ba_2REFeNb_4O_{15}$ (*RE* = rare earth atoms) causes classical ferroelectric properties [3 – 5]. However, the effect of Nd^{3+} on the properties, in particular, the optical ones, in thin films remains an unexplored issue. When controlling the optical characteristics of layers of various materials, the method of spectrophotometry is widely used. This work consisted in studying the dependence of the optical properties on high temperatures in films of neodymium barium ferroniobate ($Ba_2NdFeNb_4O_{15}$, BNFNO), grown on a MgO(001) substrate. The spectral coefficients of directional transmission of neodymium barium ferroniobate thin films on a single-crystal MgO substrate were measured using an SF-56 UVI spectrophotometer. The following parameters were set as measurement parameters: "Scanning" mode, a spectral range of 190 – 1100 nm, a sampling step of 1 nm, a measurement time of 0.2 s, a slit width of 6.0 nm. The sample was placed in an LN-121-SPECTR nitrogen filled optical cryostat in vacuum. The temperature range was changed from 20 to 180 °C. The transmission spectra show a pronounced sequence of interference maxima and minima, as well as a shift of peaks and absorption edge regions during temperature measurements. A detailed analysis of the optical spectra will make it possible to reveal the nature of the features of this material, make significant progress in the study of optical properties, and make it possible to develop recommendations for the use of these materials in the development of new devices.

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Influence of Germanium Dioxide Additive on the Dielectric Properties of Solid Solution Ceramics Based on Bismuth Ferrite and Lead Ferroniobate

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Multiferroics, which are an extensive class of materials that combine ferroelectric, ferromagnetic, and ferroelastic properties, are currently being studied in detail in connection with the potential possibility of their application in new devices, based on the mutual control of magnetic and electric fields [1, 2]. One of the most studied multiferroics is bismuth ferrite ($BiFeO_3$, BFO), which is the most popular component for designing multiferroic systems [3], as well as lead ferroniobate ($PbFe_{0.5}Nb_{0.5}O_3$, PFN). However, the widespread use of BFO and PFN is limited by a set of factors. Thus, high values of leakage currents, due to the increased electrical conductivity of solid solutions (SSs), due to the presence of oxygen vacancies, as well as impurity phases, impose restrictions on their use. This problem can be solved, among other things, by creating multicomponent materials, based on BFO and PFN with a stabilized structure and improved properties. At the same time, one of the ways to improve the manufacturability of objects and stabilize macroproperties is their modification with various elements, in particular leading to a decrease in the temperatures of synthesis and sintering of SS. The present work describes the results of studying the effect of the germanium dioxide additive GeO_2 on the dielectric parameters of the binary system $(1 - x)$ BFO – xPFN with $x = 0.3$, modified superstoichiometrically in amounts of (0.5 – 1.0) wt. %. The samples were obtained by the method of solid-phase reactions followed by sintering, using conventional ceramic technology. Measurements of the relative complex permittivity $\varepsilon^*/\varepsilon_0 = \varepsilon'/\varepsilon_0 - i\varepsilon''/\varepsilon_0$ (ε' and ε'' are the real and imaginary parts of ε^*, respectively, ε_0 is the dielectric constant) were made in the frequency range $f = 20 - 2\times10^6$ Hz in the temperature range of 20 – 650 ºC on an automatic measuring setup, based on an Agilent E4980A LCR-meter and a Varta TP703 temperature controller, respectively. It is shown that the introduction of the modifier led to a change in the nature of the

dielectric dependences in comparison with the "pure" SS compositions of these systems. An explanation for the observed effects is proposed.

Acknowledgements. The equipment of the Center for Collective Use of the Research Institute of Physics of the Southern Federal University "Electromagnetic, Electromechanical and Thermal Properties of Solids" was used. The study was carried out with the financial support of the Ministry of Science and Higher Education of the Russian Federation (State task in the field of scientific activity in 2023). Project No. FENW-2023-0010/(GZ0110/23-11-IF).

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Calculating the Structural Strength of Machine Elements with Loaded Protrusions

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Approaches that increase the correlation of hardening methods with stress state, geometric and technological factors, material properties and design features are an integral part of system design, which can be associated with the concept of structural strength. In this report, we attempt to show the possibilities of using structural strength techniques to propose an original technology for hardening machine elements with loaded projections, developing previously probated methods [1]. The studied elements have a complex shape and are loaded by bending with compression of the protrusions, the base of which is stressed by torsion, tension, or compression. In this report, the stress-strain state of machine elements with geometric concentrators is studied by modelling in the framework of elasticity: particularly, we apply a widely used Timoshenko's hypothesis, according to which the law of deformation distribution does not depend on the method of deformation and hardening of the material [2, 3]: $\tilde{\varepsilon}_x(y) = \varepsilon_T\, \varepsilon_x(y) / \varepsilon_I(y_T)$. Here, $\varepsilon_x(y)$ is relative linear deformations at the current point y for a specific cross-section at $x = \text{const}$ for an ideal absolutely elastic material, while $\tilde{\varepsilon}_x(y)$ symbolizes the same for the real material, assumed in the model; ε_T is the relative deformation, corresponding to the material yield stress; $\varepsilon_I(y_T)$ is the criteria value that characterize the switching between elastic and nonelastic deformation at the boundary point $y = y_T$ in the section of the perfectly elastic part. The developed method is compared with the results of [4] that are carried out for a tooth of a spur gear by applying an analytical approach. For calculating the stresses in the elastic part, the stress concentration theory is applied, generalized to include the cases considered.

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Comparing Analytical and Numerical Methods for Determining the Maximum Tangential Stresses of Two Contacting Parallel Circular Cylinders

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In this report, we consider some contradictions between the results on calculating maximum shear stresses and their depth in the contact area of two parallel circular cylinders, carried out with analytical and numerical methods. These contradictions are stated to be usually based on errors of the numerical approximations. However, their true case may be a distortion of the role of the curvature of contact elements in analytical solutions that should be considered accurate. Hertz theories of contact are the most common in mechanical engineering, forming the basis for standards and calculation methods. The Boussinesq – Cerruti solution of the Hertz problem assumes substituting one of the cylinders with an elastic half-space [1]. In this case, the relations $\tau_{\max}/\sigma_{z\max}$ and $h_{\tau\max}/b$, where $\tau_{\max}$ is the maximum shear stress, $\sigma_{z\max}$ is the maximum contact stress, $h_{\tau\max}$ is the depth of $\tau_{\max}$, and b is the minor axis of the elliptical contact area, are treated as independent of the curvature of the cylinders. However, the applications of the solution [2] demonstrated that, with varying one of the radii, these values correspond to those of classical theory only for a particular range of geometric parameters [3, 4]. Here, the solution [2] is compared with the finite element modelling for the contact problem. Hertz solution is assumed to be criterial, and the contradictions between the results are studied. An approach is proposed for reliable estimation of the accuracy of classical and numerical solutions of contact problems, when calculating maximum tangential stresses and their depth.

Acknowledgement. The research of Yu. E. Drobotov was carried out with the financial support of the Ministry of Science and Higher Education of the Russian Federation (State task in the field of scientific activity, scientific project No. FENW-2023-0012).

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Dielectric and Piezo-properties of a New Perovskite-like Compound of the Aurivillius Phase Family

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A new perovskite-like oxide $Bi_7CaTi_5NbO_{24}$ (number of perovskite layers, m = 3) was synthesized by a high-temperature solid-phase reaction at a temperature of 1050 °C.

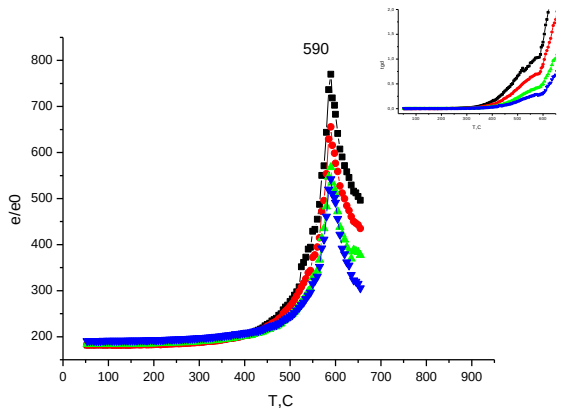

Fig. 1. Dependences of relative permittivity $\varepsilon' = \varepsilon/\varepsilon_0$ and loss angle tangent tanσ (insert) on temperature for AP $Bi_7CaTi_5NbO_{24}$ at a frequency from 100 kHz to 1 MHz, sintering temperature of 1050 °C

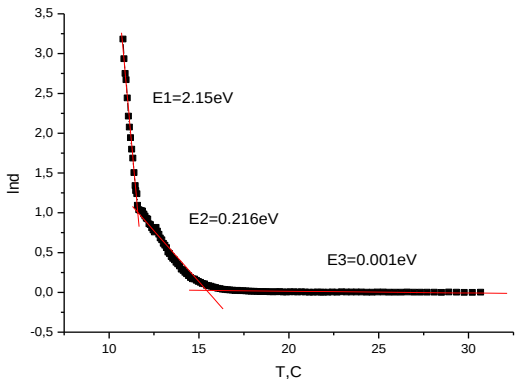

Fig. 2. Dependence of the activation energy E_a of conductivity on temperature

X-ray diffraction study showed that the compound is single-phase and has the structure of the family of Aurivillius phases (APs) [1 – 3] with parameters close to the orthorhombic unit cell,

corresponding to the space group B2cb. The relative permittivity $\varepsilon/\varepsilon_0$ and the loss tangent tanσ (inset) were measured as a function of temperature at frequencies of 100 Hz, 200 kHz, 500 kHz, and 1 MHz, see Fig. 1. The maximum Curie temperature T_c = 590 °C. Figure 2 clearly shows three regions of the activation energy E_a of the conductivity of the new compound $Bi_7CaTi_5NbO_{24}$: E_3 = 0.001 eV – intrinsic conductivity area, E_2 = 0.21 eV – transition area, E_1 = 2.15 eV – impurity conductivity area. The sample was polarized in an oil bath at 135°C in a constant electric field of 35 kV/cm^2 for 30 minutes. The measured piezoelectric modulus of the $Bi_7CaTi_5NbO_{24}$ compound was d_{33} = 5.5 pC/N.

Acknowledgement. The study was financially supported by the Russian Science Foundation (grant No. 21-19-00423) in the Southern Federal University.

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Crystal Structure and Dielectric Properties of a New Series of Perovskite-like Solid Solutions of the Aurivillius Phase Family $Bi_2SrNb_{2-x}Sn_xW_xO_9$ (x = 0.1, 0.2, 0.3, 0.4)

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Compounds belonging to the family of perovskite-like bismuth oxides are a promising basis for creating lead-free high-temperature ferroelectric ceramics [1, 2]. A new series of perovskite-like oxides $Bi_2SrNb_{2-x}Sn_xW_xO_9$ (x = 0.1, 0.2, 0.3, 0.4) has been synthesized by the method of high-temperature solid-phase reaction. To understand the nature of the synthesized series of compounds $Bi_2SrNb_{2-x}Sn_xW_xO_9$ (x = 0.1, 0.2, 0.3, 0.4), Mössbauer studies were carried out. The Mössbauer studies were carried out in absorption geometry on an MS1104Em Mössbauer spectrometer, operating in constant acceleration mode. ^{119}Sn in $CaSnO_3$ was used as sources of gamma rays. The spectrum was calibrated using the spectra of the $BaSnO_3$ and α-Fe standards. The interpretation of the Mössbauer spectra (see Fig. 1, Table 1) was carried out using the SpectrRelax software. Isomer shift (δ), quadrupole splitting(Δ), line width (Γ) and component area (A) were calculated. The relative permittivity and loss tangent for compounds of the $Bi_2SrNb_{2-x}Sn_xW_xO_9$ series (x = 0.1, 0.2, 0.3, 0.4) were measured in the range from room temperature to 750°C at a frequency from 100 kHz to 1MHz.

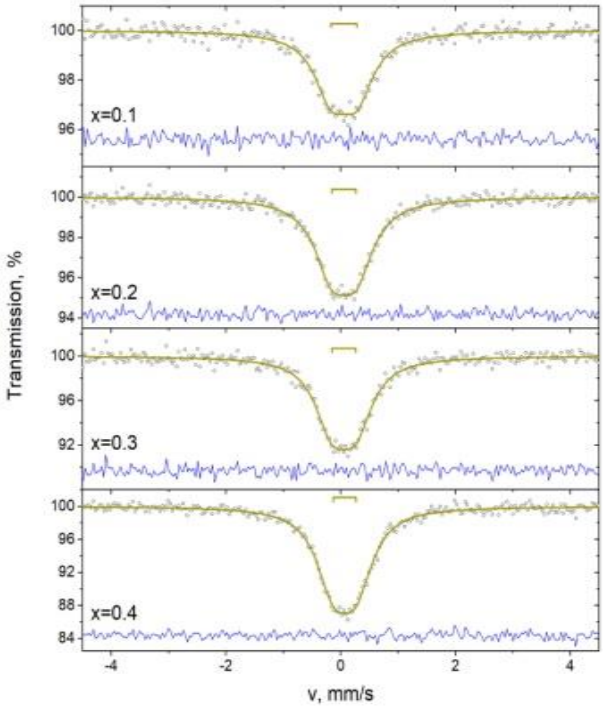

Fig. 1 Room temperature ^{119}Sn Mossbauer spectra of $Bi_2SrNb_{2-x}Sn_xW_xO_9$ (x = 0.1,0.2, 0.3, 0.4) samples

Table 1. Parameters of Room temperature ^{119}Sn Mossbauer spectra of $Bi_2SrNb_{2-x}Sn_xW_xO_9$ (x = 0.1, 0.2, 0.3, 0.4) samples

Component	$\delta \pm 0.02$, mm/s	$\Delta \pm 0.02$, mm/s	$\Gamma \pm 0.02$, mm/s	$A \pm 1$, %
$Bi_2SrNb_{1.9}Sn_{0.1}W_{0.1}O_9$	0.06	0.45	0.73	100
$Bi_2SrNb_{1.8}Sn_{0.2}W_{0.2}O_9$	0.06	0.43	0.72	100
$Bi_2SrNb_{1.7}Sn_{0.3}W_{0.3}O_9$	0.05	0.48	0.73	100
$Bi_2SrNb_{1.6}Sn_{0.4}W_{0.4}O_9$	0.07	0.39	0.73	100

Acknowledgement. The study was carried out with the financial support of the Ministry of Science and Higher Education of the Russian Federation (State task in the field of scientific activity, scientific project No. FENW-2023-0012).

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A New Perovskite-like Compound of the Aurivillius Phase Family with an Increased Piezoelectric Modulus

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A new perovskite-like oxide, $Bi_7Sr_2TiNb_5O_{27}$ (m = 2), has been synthesized by a high-temperature solid-phase reaction at a temperature of 1050 °C. The X-ray diffraction study

showed that the compound is single-phase and has the structure of the family of Aurivillius phases (APs) [1 – 3] with parameters close to the orthorhombic unit cell, corresponding to the space group $A2_1am$.

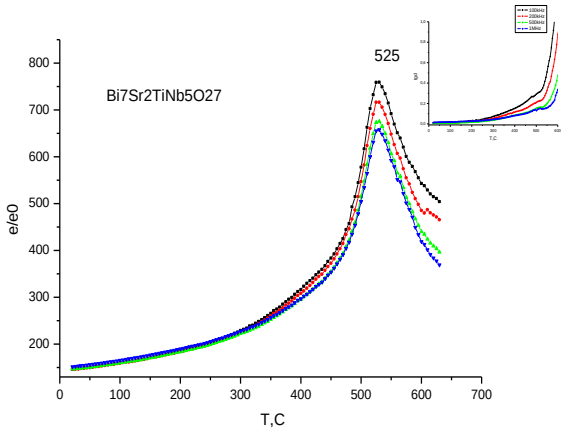

Fig. 1

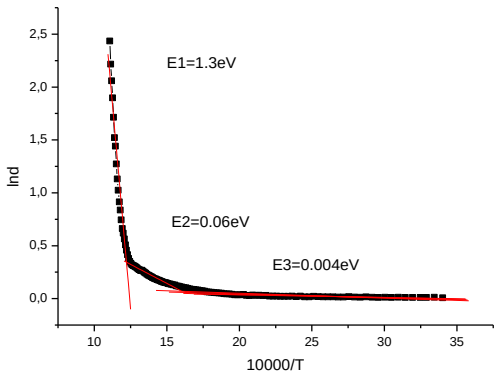

Fig. 2

Fig. 1. Dependences of relative permittivity $\varepsilon' = \varepsilon/\varepsilon_0$ and loss angle tangent $\tan\sigma$ (insert) on temperature for $Bi_7Sr_2TiNb_5O_{27}$ at frequencies from 100 kHz to 1 MHz, sintering temperature 1050°C
Fig. 2. Dependence of activation energy E_a of conduction on temperature.

The relative permittivity $\varepsilon/\varepsilon_0$ and the loss tangent $\tan\sigma$ (Fig. 1, inset) were measured as functions of temperature at frequencies of 100 Hz, 200 kHz, 500 kHz, and 1 MHz.The maximum Curie temperature T_c = 525 °C. Figure 2 clearly distinguishes two regions of the activation energy E_a of the conductivity for compound $Bi_7Sr_2TiNb_5O_{27}$: E_3 = 0.004 eV is the intrinsic conductivity and E_1 = 1.3 eV is the impurity conductivity. The sample was polarized in an oil bath at 135 °C in DC field of 35 kV/cm^2 for 30 minutes. The measured piezoelectric modulus of the $Bi_7Sr_2TiNb_5O_{27}$ compound was d_{33} =12 pC/N. The synthesized compound $Bi_7Sr_2TiNb_5O_{27}$ can be the base for creating a new piezoelectric material.

Acknowledgement. The study was financially supported by the Russian Science Foundation (grant No. 21-19-00423) in the Southern Federal University.

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[3] S. V. Zubkov, I. A. Parinov, Y. A. Kuprina // *Electronics, MDPI*, **11**(2), 277 – 287, 2022.

Dielectric Properties of Nd-Doped $SrBi_{2-x}Nd_xNb_2O_9$

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Compounds belonging to the family of perovskite-like bismuth oxides are a promising basis for the creation of lead-free high-temperature ceramics. To understand the nature of the

improvement in piezoelectric properties, the crystalline dielectric properties and microstructure of the synthesized compounds were studied.

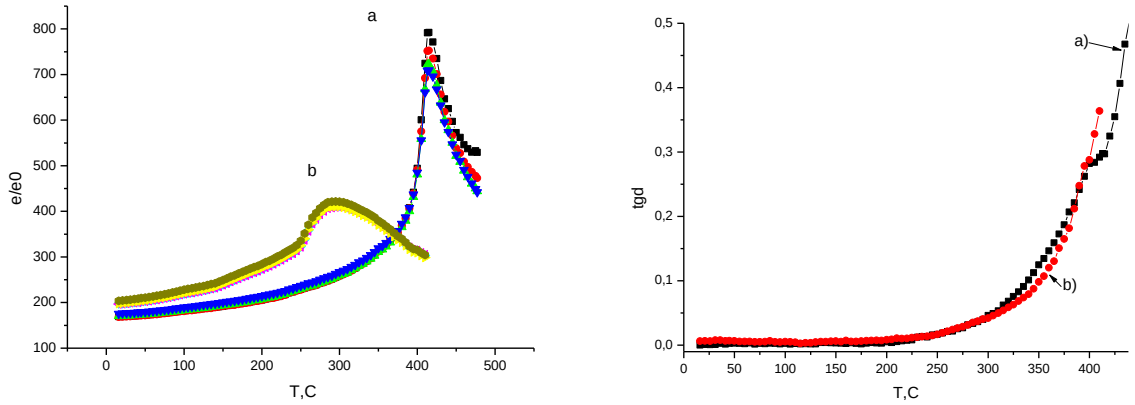

Fig. 1. Dependences of relative permittivity $\varepsilon' = \varepsilon/\varepsilon_0$ and loss tangent tan$d$ on temperature for $SrBi_{2-x}Nd_xNb_2O_9$: (a) x = 0.0; (b) x = 0.2 at a frequency from 100 kHz to 1 MHz, a sintering temperature of 1100 °C.

In this report, the change in dielectric constant with temperature for a lot of synthesized compounds $SrBi_{2-x}Nd_xNb_2O_9$ (x = 0.0, 0.2) was studied, the changes in the crystal lattice parameters were obtained when Bi^{3+} ions were replaced by Nd^{3+} ions, the coefficient of the piezoelectric modulus d_{33} was measured, and the microstructure of the synthesized compounds was obtained (see Fig. 1). Based on X-ray diffraction, it was established that there are no additional reflections in the diffraction patterns. This indicates the mono composition of the synthesized compound. Based on the results of the study of the synthesized compounds, it was found that the doping of the main compound with Nd atoms leads to a decrease in the Curie temperature, a decrease in the dielectric loss tangent, and an increase in the piezoelectric coefficient d_{33}.

Acknowledgement. The study was carried out with the financial support of the Ministry of Science and Higher Education of the Russian Federation (State task in the field of scientific activity, scientific project No. FENW-2023-0012).

References

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Effect of Sintering Temperature on the Microstructure and Dielectric Properties of Nd-Doped $Bi_4Ti_3O_{12}$

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A novel set of perovskite-like oxides $Bi_{4-x}Nd_xTi_3O_{12}$ (x = 0.1, 0.3, 0.5, 0.7) were synthesized by using the method of high-temperature solid-state reaction at temperatures of 1000°C and 1050°C. The X-ray diffraction investigation demonstrated that these compounds are single-phase and had the structure of the family of Aurivillius phases (APs) with parameters near to the orthorhombic unit cell corresponding to the spatial group B2cb. The study of the microstructure also showed that the crystallites had a shape characteristic of AP. The relative permittivity and the loss tangent were measured as functions of temperature at various frequencies. For all prepared compounds, the microstructure was studied at different sintering temperatures. The results of experimental studies are present in Figs. 1 – 5, where:

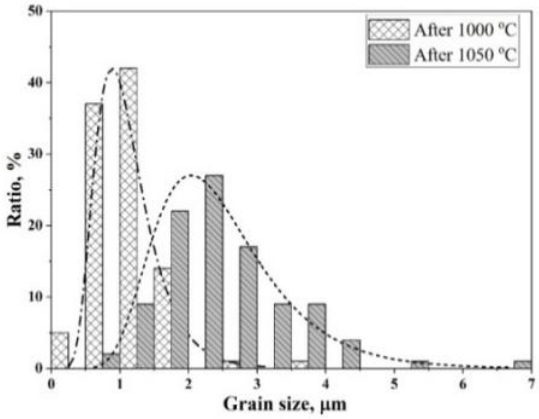

Fig. 1

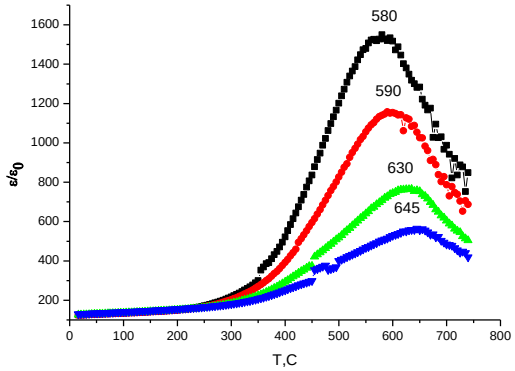

Fig. 2

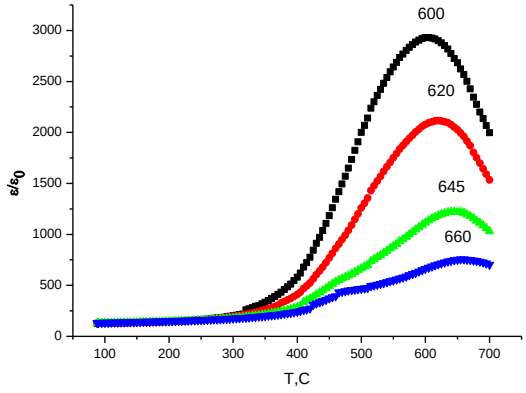

Fig. 3

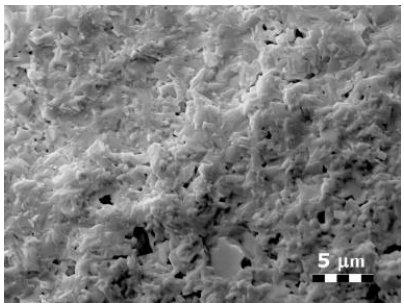

Fig. 4

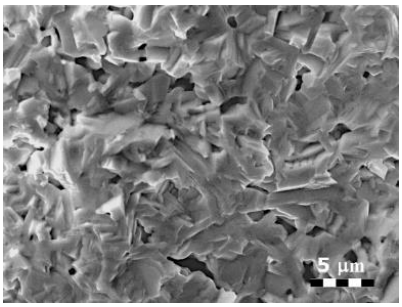

Fig. 5

Fig. 1. Grain size distribution in $Bi_{3.5}Nd_{0.5}Ti_3O_{12}$ ceramics after synthesis at T = 1000 °C and T = 1050 °C.

Figs. 2, 3. Dependences of relative permittivity $\varepsilon' = \varepsilon/\varepsilon_0$ on temperature for $Bi_{4-x}Nd_xTi_3O_{12}$ (x = 0.1, 0.3, 0.5, 0.7) manufactured at a sintering temperature of 1000 °C and 1050 °C, respectively.

Figs. 4, 5. Microstructure of the cleavage surface of $Bi_{3.3}Nd_{0.7}Ti_3O_{12}$ ceramics after synthesis at 1000 °C and 1050 °C, respectively.

As expected, Nd^{3+} doping reduced the dielectric loss by a factor of two, compared to undoped $Bi_4Ti_3O_{12}$. The maximum Curie temperature T_C = 660 °C was attained for $Bi_{4-x}Nd_xTi_3O_{12}$ at x = 0.1. Doping with Nd^{3+} lowered the Curie temperature in the dependence on the concentration. The dielectric permittivity values for all samples sintered at 1050 °C were 1.5 – 2 times greater than for samples sintered at 1000 °C. All specimens were characterized by increasing the grain size with growth.

Acknowledgements. This work was supported by the Russian Science Foundation (project No. 21-19-00423) in the Southern Federal University.

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Structure and Properties of DC Magnetron Deposited TiN and AlN Coatings with Different Stoichiometry

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Physical, mechanical and tribological properties of structural materials are the main indicators of the reliability and durability of friction units, which are characterized by hardness and wear resistance. The surface layer is the object from which the destruction of the part begins as the main contact deformation processes, localized in it. Increased reliability and durability of the parts is achieved by forming coatings of different compositions and morphologies on products while controlling the technological deposition modes. Coatings formed on the base of nitride and carbide compounds have received wide practical application in mechanical engineering,

among which aluminum nitride (AlN) and titanium nitride (TiN) can be highlighted. TiN coatings have proven successful in improving the durability of machining tools due to their high hardness, thermal and chemical stability, and low electrical resistivity. In the present research the coatings were deposited by reactive DC magnetron sputtering using a VSM 100 system (ROBVAC, Russia) at a constant chamber pressure of 0.78 Pa. The sputtering power was 150 W at a temperature of 100 °C for AlN and 300 – 450 W for TiN at a temperature of 200 °C. The nitrogen flow in the chamber varied from 1 to 3 cm^3/min for each coating. Silicon wafers with orientation (100) were used as substrates. The study and analysis of the morphological features, physical, mechanical and tribological properties of coatings, such as Young's modulus, microhardness, friction coefficient, were carried out using a 750 Ubi nanoindentation system (USA, Hysitron) using a diamond indenter with a radius of 226 nm. The conducted studies demonstrated that the physical, mechanical and tribological properties of TiN and AlN coatings strongly depend on the stoichiometric composition of the coatings. As a result, a relationship was established between the amount of nitrogen in coatings and their properties, and parameters for applying TiN and AlN coatings with high physical, mechanical and tribological properties were identified. The resulting coatings have a high Young's modulus and microhardness, as well as a low coefficient of friction: E = 181±14 GPa, H = 11.6±1.5 GPa, k_{fr} = 0.09 for TiN and E = 65.1±16.3 GPa, H = 1.1±0.5 GPa, k_{fr} = 0.24 for AlN.

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- Vinh Long University of Technology Education, Vinh Long City

SCHEDULE

2023 International Conference on "Physics and Mechanics of New Materials and Their Applications" (PHENMA 2023) Surabaya, Indonesia, October 03-08, 2023

Universitas 17 Agustus 1945 (UNTAG) Surabaya Jl. Semolowaru 45 Surabaya 60118, Jawa Timur, Indonesia

3 October 2023 (Tuesday)

Arrival and registration of the PHENMA 2023 participants in Surabaya

4 October 2023 (Wednesday)

Venue:

1. Opening Ceremony : Rektorat & Yayasan Building (6th floors).
2. Oral Presentation : Graha Prof. H. Roeslan Abdulgani Building, Engineering Faculty, 2nd (Room Q205 and Q210) and 10th floors (Room-Vokasi).
3. Video Presentation : Graha Wiyata Building, Meeting Room (1st Floor), Platform: Zoom Meeting
4. Poster Presentation : Graha Wiyata Building (1st Floor)
5. Time : Western Indonesia Time (WIB), Surabaya, Indonesia WIB (UTC +7) https://www.timeanddate.com/worldclock/converter.html?iso=20230910T050000&p1=631

Time (UTC+7)	Activity
08.00 – 09.00	Registration of the PHENMA 2023 participants at REGISTRATION DESK Video Screening of UNTAG Company Profile and PHENMA Photos
09.00 – 09.05	Opening Ceremony
09.05 – 09.10	Sing: Indonesia Raya Anthem and Hymn UNTAG Surabaya
09.10 – 09.20	Opening Speech 1: Assoc. Prof. Erni Puspanantasari Putri, S.T., M.Eng., Ph.D. Head of Research Center, Universitas 17 Agustus 1945 Surabaya
09.20 – 09.30	Opening Speech 2: Assoc. Prof. Dr. Ir. Sajiyo., M.Kes., IPU., ASEAN ENG Dean of Engineering Faculty, Universitas 17 Agustus 1945 Surabaya
09.30 – 09.40	Opening Speech 3: Prof. Dr. Mulyanto Nugroho, M.M., CMA., CPA Rector, Universitas 17 Agustus 1945 Surabaya
09.40 – 09.50	Opening Speech 4: J. Subekti, SH., MM. Head, Yayasan Perguruan 17 Agustus 1945 Surabaya
09.50 – 10.00	Congrats Address 1: Prof. DrSc. Ivan A. Parinov (Southern Federal University, Russia)
10.00 – 10.10	Congrats Address 2: Prof. Dr. Shun-Hsyung Chang (National Kaohsiung University of Science and

	Technology, Taiwan)
10.10 – 10.20	Souvenir Exchange
10.20 – 10.30	Group photo
10.30 – 10.50	Coffee Break
10.50 – 11.25	Plenary Report 1: Dr. Yu. E. Drobotov. The Solvability of Integral Equations of the First Kind with Mild Singularity Kernels. *Southern Federal University, Russia*
11.25 – 12.00	Plenary Report 2: Assoc. Prof. Dr. I Made Kastiawan, ST., MT. Mechanical Study of Coconut Shell Particles Reinforced Polypropylene Matrix Towards an Environmentally Friendly Alternative Material. *Department of Mechanical Engineering, Universitas 17 Agustus 1945 Surabaya, Indonesia.*
12.00 – 13.00	Lunch
13.00 – 14.30	Oral, Video Presentation, and Poster - Sessions A
14.30 – 14.45	Coffee Break
14.45 – 16.00	Oral, Video Presentation, and Poster - Sessions B

5 October 2023 (Thursday)

Time (UTC+7)	Activity
08.00 – 09.00	Registration of the PHENMA 2023 participants at REGISTRATION DESK
09.00 – 09.30	Plenary Report 1: Prof. Dr. Hung-Yu Wang. Circuit Transform using Pathological circuit Elements, *Department of Electronic Engineering, National Kaohsiung University of Science and Technology, Taiwan*
09.30 – 10.00	Plenary Report 2: Assoc. Prof. Erni Puspanantasari Putri, S.T., M.Eng., Ph.D. Erni Puspanantasari Putri. Teyeng Batik: A New Innovation for Making Motifs on Batik Using Iron Rust Stains. *Department of Industrial Engineering, Universitas 17 Agustus 1945 Surabaya, Indonesia.*
10.30 – 10.45	Coffee Break
10.45 – 12.00	Oral, Video Presentation, and Poster - Sessions A
12.00 – 13.00	Lunch
13.00 – 14.30	Oral, Video Presentation and Poster Sessions B
14.30 – 15.00	Coffee Break
15.00 – 16.00	Closing Ceremony
16.00 – 18.00	Dinner

6 October 2023 (Friday)

1st day Culture Trip – Surabaya City Tour

7 October 2023 (Saturday)

2nd day Culture Trip – Extension Trip

8 October 2023 (Sunday)

Departure of Participants

ORAL PRESENTATION

4 October 2023 (Wednesday): Oral Presentation

Venue:
Graha Prof. H. Roeslan Abdulgani Building, Engineering Faculty,
Universitas 17 Agustus 1945 Surabaya, Indonesia
2nd Floor (Room Q205 and Q210) and 10th Floor (Room-Vokasi).

Date	**October 4, 2023**	
Time (UTC+7)	**General Presentation** **Session A** **Graha Prof. H. Roeslan Abdulgani Building, Engineering Faculty** **2nd Floor (Room Q205 and Q210) and 10th Floor (Room-Vokasi)**	
	Chairperson: Prof. Min Yen Yeh **Co- Chairperson:** **Dr. RA. Retno Hastijanti, ST., MT.**	**Room A1 - Q210 (2nd Floor)**
13.00 – 13.15	Prof. Dr. Shun-Hsyung Chang *Department of Microelectronics Engineering, National Kaohsiung University of Science and Technology, Kaohsiung City, Taiwan* shchang@nkust.edu.tw	Research of Hydrophones with Zinc Oxide Nanopillars and Seed Layers Grown on Three Types of Substrates
13.15 – 13.30	Prof. Min Yen Yeh, *Department of Microelectronics Engineering, National Kaohsiung University of Science and Technology, Kaohsiung, Taiwan* minyen@nkust.edu.tw	Assembly and Investigation of Electrochromic Devices
13.30 – 13.45	Dr. Yu. E. Drobotov *Southern Federal University, Russia* yu.e.drobotov@yandex.ru	The Effect of Approach in the Contact Problem for Two Elastic Parallel Circular Cylinder
13.45 – 14.00	Dr. Yu. E. Drobotov *Southern Federal University, Russia* yu.e.drobotov@yandex.ru	A Convolution Integral Equation of the Third Kind in the Grand Lebesgue Spaces and Some Applications
14.00 – 14.15	Dr. RA. Retno Hastijanti, ST., MT. *Department of Architecture, Universitas 17 Agustus 1945 Surabaya, Indonesia* retnohasti@untag-sby.ac.id	Development of Aesthetic Red Brick as an Alternative Material Based on Green Architecture
14.15 – 14.30	Indah Nurpriyanti, SPd., M.Sc. *Department of Mechanical Engineering, Universitas 17 Agustus 1945 Surabaya, Indonesia* indahnurpriyanti@untag-sby.ac.id	Synthesis and Characterization of $ZnFe_2O_4$ Based on Iron Sand as a Magnetic Particle Material
	Chairperson: **Dr. Vladimir Kaydashev** **Co-Chairperson:** **Tigor Wilfritz Soaduon Panjaitan, S.T., M.T., Ph.D.**	**Room A2 - Q205 (2nd Floor)**
13.00 – 13.15	Dr. Vladimir Kaydashev (Laboratory of Nanomaterials, Southern Federal University, Rostov-on-Don, Russia) kaydashev@gmail.com	Vanadium Dioxide Films on $LiNbO_3$ Substrates for Programmed Gradient Metasurfaces

13.15 – 13.30	Dr. Chai-Sheng Wen *(Department of Electrical Engineering, National Taiwan Ocean University, Keelung City, Taiwan)* 21053001@mail.ntou.edu.tw	Integrated Circuit Testing Engineer Competency Accreditation System to Shorten the Gap between Learning and Field
13.30 – 13.45	Dr. A.S. Kornievsky (Institute of Mathematics, Mechanics and Computer Sciences, Southern Federal University, Rostov-on-Don, Russia) kornievskiy@sfedu.ru	Finite Element Investigation of Mechanical Properties of Highly Porous Nanoscale Materials with Different Geometry Structures of Gibson-Ashby Cells
13.45 – 14.00	Tigor Wilfritz Soaduon Panjaitan, S.T., M.T., Ph.D. *Department of Architecture, Universitas 17 Agustus 1945 Surabaya, Indonesia* tigorwilfritz@untag-sby.ac.id	The Commercialization of Public Space in Indonesian Cities: Whose Takes Benefits?
14.00 – 14.15	Dika Ayu Safitri, ST., MT. *Department of Civil Engineering, Universitas 17 Agustus 1945 Surabaya, Indonesia* dika-ayu@untag-sby.ac.id	Temporal Mapping of Coastal Areas Using Landsat Satellite Imagery
	Chairperson: **Sigit Ananda Murwato, S.Kom., M.MT.**	**Room A3 - Vokasi**
13.00 – 13.15	Achmad Rizki Dwi Putra *Engineering Faculty, Universitas 17 Agustus 1945 Surabaya, Indonesia* commjs273@gmail.com	Productivity Analysis of PT. Tjakrindo Mas Gresik Using OMAX Method: Criterion Mapping and Weight Determination for Operational Efficiency Enhancement.
13.15 – 13.30	Adelia Hana Firnanda *Engineering Faculty, Universitas 17 Agustus 1945 Surabaya, Indonesia* adeliahanafirnanda@gmail.com	Illuminating the Future: Innovation in Making Simple Study Lamps Using Inventor.
13.30 – 13.45	Agil Wahyu Pambudi *Engineering Faculty, Universitas 17 Agustus 1945 Surabaya, Indonesia* agilsoapking@gmail.com	Implementation of Transportation Methods on Efficiency of Wood Pallet Company Shipping
13.45 – 14.00	Safira Zahra Nisriina *Engineering Faculty, Universitas 17 Agustus 1945 Surabaya, Indonesia* zsafira122@gmail.com	Productivity Increasing Business in Door Manufacture Using the Objective Matrix (OMAX) Method. (Study Case in PT. Sarana Kreasi Lestari)
14.00 – 14.15	Alifiah Wulan Syafira *Engineering Faculty, Universitas 17 Agustus 1945 Surabaya, Indonesia* alifiahws@gmail.com	Case Study of Calculation of Productivity Index (PI) Using the Mundel Approach at PT Kosmetika Global Indonesia
14.15 – 14.30	Bayu Cahyo Nugroho *Engineering Faculty, Universitas 17 Agustus 1945 Surabaya, Indonesia* bcahyo096@gmail.com	Application of the Integer Programming Method to Calculate the Minimum Production Costs and Dietary Requirements
	Chairperson: **Elisa Sulistyorini, ST., MT.**	**Room A4 - Vokasi**
13.00 – 13.15	Sani Zakiyah Maharani *Engineering Faculty,*	Optimization of Iron Production Planning at Pande Besi Using the Goal Programming

	Universitas 17 Agustus 1945 Surabaya, Indonesia smhrni22@gmail.com	Method
13.15 – 13.30	Andika Pratama *Engineering Faculty, Universitas 17 Agustus 1945 Surabaya, Indonesia* dikakasep04@gmail.com	Comparison of the Productivity of Seasoning Processing PT. Inti Dragon Suryatama
13.30 – 13.45	Andiko Prasetyo *Engineering Faculty, Universitas 17 Agustus 1945 Surabaya, Indonesia* andikoprasetyo07@gmail.com	Proposed Increase in Productivity on the Production Floor Using the Method of Objective Matrix (OMAX) for PT. Inti Dragon Suryatama
13.45 – 14.00	Achmad Izzurromadlon *Engineering Faculty, Universitas 17 Agustus 1945 Surabaya, Indonesia* Achmadizzur057@gmail.com	Design of a Roll Welding Turntable as a Welding Tool (Case Study: Art Welding Pt. Meco Inoxprima).
14.00 – 14.15	Bintang Kharisma Ramadhan *Engineering Faculty, Universitas 17 Agustus 1945 Surabaya, Indonesia* b1nt4ngk4r1s@gmail.com	Productivity Measurement Using the Marvin E. Mundel Method: Marvin E. Mundel and Productivity Evaluation Tree (PET)
14.15 – 14.30	Sarah Yunita Amela *Engineering Faculty, Universitas 17 Agustus 1945 Surabaya, Indonesia* sarahyunitaaa28@gmail.com	Risk Management in Project Construction
14.30 – 14.45	Coffee Break	
	General Presentation **Session B** **Graha Prof. H. Roeslan Abdulgani Building, Engineering Faculty** **2nd Floor (Room Q205 and Q210) and 10th Floor (Room-Vokasi)**	
	Chairperson: **Dr. Jaka Purnama, ST., MT.**	**Room B1 - Q210 (2nd Floor)**
14.45 – 15.00	Dr. Ir. Sajiyo, M.Kes., IPU., ASEAN ENG. *Department of Industrial Engineering, Universitas 17 Agustus 1945 Surabaya, Indonesia* sajiyo@untag-sby.ac.id	Standard Working Time Analysis of the Production Section at CV. Wana Indo Raya Lumajang Indonesia
15.00 – 15.15	Nurul Rochmah, ST., MT. *(Department of Civil Engineering, Universitas 17 Agustus 1945 Surabaya, Indonesia)* nurul-rochmah@untag-sby.ac.id	The Effect of Variations in Coconut Fiber Ash Waste as Added Material in Mortar
15.15 – 15.30	Dr. Jaka Purnama, ST., MT. *Department of Industrial Engineering, Universitas 17 Agustus 1945 Surabaya, Indonesia)* jakapurnama@untag-sby.ac.id	Analysis of Balanced Furniture Product Requirements with Fuzzy Goal Programming Model Development
15.30 – 15.45	Erni Puspanantasari Putri, ST., M.Eng., Ph.D. Department of Industrial Engineering, Universitas 17 Agustus 1945 Surabaya, Indonesia	Renewable Energy: Charcoal Briquettes from Coconut Shells

	erniputri@untag-sby.ac.id	
15.45 – 16.00	Dr. Tomy Michael, SH., MH. *Department of Law, Universitas 17 Agustus 1945 Surabaya, Indonesia* tomy@untag-sby.ac.id	The Important Role of Museum Management at the NU Museum as an Introduction to the Community
16.00 – 16.15	Dr. Tomy Michael, SH., MH. *Department of Law, Universitas 17 Agustus 1945 Surabaya, Indonesia* *tomy@untag-sby.ac.id*	Management in Legalizing Ethnographic Museum Tourism
	Chairperson: **Yusuf Eko Nurcahyo, MT., S.T.**	**Room B2 - Vokasi**
14.45 – 15.00	Agatha Hannabel Avnanta Puteri *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* d.agatha44@gmail.com	The Potential of 3D-Based Manufacturing Technology Using AutoCAD Application for Product Innovation.
15.00 – 15.15	Ahmad Tristanto *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* ahmdtristanto@gmail.com	Achievement of Performance Against Targets Using the OMAX Method
15.15 – 15.30	Davin Herdiansyah Putra *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* davinsyahputra07@gmail.com	Case Study of Decision Making Based on Uncertainty Preparation of Payoff Matrix: A Case in PT Dua Putra Jaya
15.30 – 15.45	Dian Rahma Aulia *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* diannn.draaa@gmail.com	Drilling, Bending, Turning, and Assembly Processes in the Steel Shoe Rack Manufacturing Industry
15.45 – 16.00	Erlina Firdah Lestari *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* erlinafirdah@gmail.com	Productivity Measurement Using the Objective Matrix Method at PT Yupi Indo Jelly Gum
16.00 – 16.15	Fachrezi Pramudia Ananta *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* fachrezi.pramudia@gmail.com	Productivity Analysis Using Omax Method (Case Study: PT. Sumber Bhakti)
	Chairperson: **Pongki Lubis Wahyudi, ST., MT.**	**Room B3 - Vokasi**
14.45 – 15.00	Elvia Defitriana Putri *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* viaadefitt12@gmail.com	Productivity Measurement with OMAX Method (PT. Sentosa Abadi)
15.00 – 15.15	W. K. Erlangga *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* erlanggawk088@gmail.com	The Effect of Investment Decisions, Funding Decisions, Profitability and Interest Rates (Bi Rate) on Firm Value in Food and Drink Companies
15.15 – 15.30	Evi Hidayati *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,*	The Role of AutoCAD Software in Industrial Engineering

	Indonesia evihidayati0302@gmail.com	
15.30 – 15.45	Fachrezi Pramudia Ananta *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia* fachrezi.pramudia@gmail.com	Productivity Calculation Analysis Using Mundel Method (Case Study: PT. Multi Jaya Glass)
15.45 – 16.00	Faricha Amarah Dhani *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia* faricha.ad@gmail.com	Measurement of Company Productivity PT. Silver Box with the Objective Matric (OMAX) Method
16.00 – 16.15	Haekal Ardy *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia* haekal.ardy8@gmail.com	Decision-Making under Uncertainty: Strategies for Navigating Ambiguity

5 October 2023 (Thursday): Oral Presentation

Date	**October 5, 2023**	
Time (UTC+7)	**General Presentation** **Session C** **Graha Prof. H. Roeslan Abdulgani Building, Engineering Faculty** **2nd Floor (Room Q205 and Q210) and 10th Floor (Room-Vokasi)**	
	Chairperson: **Prof. DrSc. Ivan A. Parinov**	**Room C1 - Q210 (2nd Floor)**
10.45 – 11.00	Prof. DrSc. Ivan A. Parinov *I. I. Vorovich Mathematics, Mechanics and Computer Sciences Institute, Southern Federal University, Rostov-on-Don, Russia* parinov_ia@mail.ru	Piezoelectric Energy Harvesting for Last Decade, Southern Federal University, Rostov-on-Don, Russia
11.00 – 11.15	Dr. Alexander Cherpakov *I. I. Vorovich Institute of Mathematics, Mechanics and Computer Science, Southern Federal University, Rostov-on-Don, Russia* alex837@yandex.ru	Conducting research on an axial T-shaped piezoelectric generator, Southern Federal University, Rostov-on-Don, Russia
11.15 – 11.30	Dr. Prateek Upadhyay *Discipline of Mechanical Engineering, PDPM Indian Institute of Information Technology, Design and Manufacturing, Jabalpur, India* prateeku959@gmail.com	Design and Analysis of Piezoaeroelastic Energy Harvester for Mid-range Wind Velocity Applications
11.30 – 11.45	Elisa Sulistyorini, ST., MT. *Department of Mechanical Engineering, Universitas 17 Agustus 1945 Surabaya, Indonesia* elisasulistyorini@untag-sby.ac.id	Effect of the Percentage of Sugar Factory Kettle Ash and Coconut Shell Charcoal on the Calorific Value of Briquettes
11.45 – 12.00	Erni Puspanantasari Putri, ST., M.Eng., Ph.D. *Department of Industrial Engineering, Universitas 17 Agustus 1945 Surabaya, Indonesia*	Ecoprint: Contemporary Batik Materials Using Plant Waste

	erniputri@untag-sby.ac.id	
	Chairperson: **Dr. Andarita Rolalisasi., ST., MT.**	**Room C2 - Q205 (2nd Floor)**
10.45 – 11.00	Michella Beatrix S.T., M.T. *Department of Civil Engineering,* *Universitas 17 Agustus 1945* *Surabaya, Indonesia* michella@untag-sby.ac.id	Analysis of Factors Affecting Construction and Demolition Waste Generation in Surabaya City
11.00 – 11.15	Dr. Andarita Rolalisasi., ST., MT. (Program Studi Arsitektur, Fakultas Teknik, Universitas 17 Agustus 1945 Surabaya, Indonesia) rolalisasi@untag-sby.ac.id	Sustainable Resettlement of Volcano Eruption Victim Case: Sumbermujur, Lumajang
11.15 – 11.30	Budiarsih, SH., MH., Ph.D. (Department of Law Universitas 17 Agustus 1945 Surabaya, Indonesia) budiarsih@untag-sby.ac.id	The Management and Financing System for the Healthy Pekanbaru Program for the Poor in Pekanbaru, Indonesia.
11.30 – 11.45	Budiarsih, SH., MH., Ph.D. Department of Law, Universitas 17 Agustus 1945 Surabaya, Indonesia budiarsih@untag-sby.ac.id	Management and Strategy for Handling Former Narcotics Addicts through the Indonesian Drug-Free Healthy Young Generation Program at the Kediri Indonesia Eklesia Social Institution.
	Chairperson: **Dika Ayu Safitri, ST., MT.**	**Room C3 - Vokasi**
10.45 – 11.00	Adhindha Putri Mayangsari *Engineering Faculty,* *Universitas 17 Agustus 1945* *Surabaya, Indonesia* adhindhaputri12@gmail.com	Development of Innovative Clothesline Design Using Autodesk Inventor for Indoor.
11.00 – 11.15	Agil Wahyu Pambudi *Engineering Faculty,* *Universitas 17 Agustus 1945* *Surabaya, Indonesia* agilsoapking@gmail.com	Optimization of Celurite Production Using Goal Programming
11.15 – 11.30	Ahmad Tristanto *Engineering Faculty,* *Universitas 17 Agustus 1945* *Surabaya, Indonesia* ahmdtristanto@gmail.com	Method of Measuring the Cost of Production as Input with the Marvin Mundel Method
11.30 – 11.45	Davin Herdiansyah Putra *Engineering Faculty,* *Universitas 17 Agustus 1945* *Surabaya, Indonesia* davinsyahputra07@gmail.com	Productivity Index calculation using Mundel Approach data at PT. Dua Putra Jaya furniture
11.45 – 12.00	Dheni Rahmat Putra *Engineering Faculty,* *Universitas 17 Agustus 1945* *Surabaya, Indonesia* dhenirahmatputra09@gmail.com	Analysis of Productivity Using the OMAX Method at Tessa Bakery
12.00 – 12.45	Fakhrus Shirooth Busyro *Engineering Faculty,* *Universitas 17 Agustus 1945* *Surabaya, Indonesia* fahrusb123@gmail.com	Simultaneous Analysis of the Monetary Sector in Indonesia (Mundel – Fleming Partial Approach)
	General Presentation	

	Session D Graha Prof. H. Roeslan Abdulgani Building, Engineering Faculty 2nd Floor (Room Q205 and Q210) and 10th Floor (Room-Vokasi)	
	Chairperson: **Dr. Jaka Purnama, ST., MT.**	**Room D1 - Vokasi**
13.00 – 13.15	Allan Febriyanto *Engineering Faculty,* *Universitas 17 Agustus 1945* *Surabaya, Indonesia* bigbosss170204@gmail.com	Development of Bicycle Chain Cutting Tools with Quality Function Deployment (QFD) Method
13.15 – 13.30	Achmad Rizki Dwi Putra *Engineering Faculty,* *Universitas 17 Agustus 1945* *Surabaya, Indonesia* commjs273@gmail.com	Analysis of the Productivity Index (PI) Calculation Using the Mundel Approach in the Food and Beverage Company PT. Sinergitas Indonesia Muda
13.30 – 13.45	Arij Basmin Basmala *Engineering Faculty,* *Universitas 17 Agustus 1945* *Surabaya, Indonesia* arijbasminb@gmail.com	Productivity Measurement Using the OMAX (Objective Matrix) Method
13.45 – 14.00	Awanda Firdaus Muswati *Engineering Faculty,* *Universitas 17 Agustus 1945* *Surabaya, Indonesia* awandaafirdaus@gmail.com	Evaluation and Productivity Analysis using Mundel Method in PT. AFM
14.00 – 14.15	Badrus Sibyan Zain *Engineering Faculty,* *Universitas 17 Agustus 1945* *Surabaya, Indonesia* Badrussz17@gmail.com	Productivity Analysis Using Marvin E. Mundel Method (Study Case in PT. PC)
14.15 – 14.30	Bella Kharisma *Engineering Faculty,* *Universitas 17 Agustus 1945* *Surabaya, Indonesia* bellakharisma57@gmail.com	Getting the Duration of Rigid Pavement Work
	Chairperson: **Indah Nurpriyanti, SPd., M.Sc.**	**Room D2 - Vokasi**
13.00 – 13.15	Davin Herdiansyah Putra *Engineering Faculty,* *Universitas 17 Agustus 1945* *Surabaya, Indonesia* davinsyahputra07@gmail.com	Proposed Strategy for Increasing Productivity Based on the Results of Objective Matrix (OMAX) Method in the Transformer Production Department at PT. Gkuad Manufacturing (Case Study PT. Gkuad)
13.15 – 13.30	Fauzi Irfan Wiranda *Engineering Faculty,* *Universitas 17 Agustus 1945* *Surabaya, Indonesia* fauziirfn17@gmail.com	Measurement of Productivity by Marvin E. Mundel Method
13.30 – 13.45	Fikrie Muzhaffar Fadhlurohman *Engineering Faculty,* *Universitas 17 Agustus 1945* *Surabaya, Indonesia* fikriemf27@gmail.com	Proposed Strategy for Increasing Productivity Based on the Results of Objective Matrix (OMAX) Measurement Analysis in the Transformer Production Department at PT. Netsle Indonesia Manufacture
13.45 – 14.00	Fito Firmansyah *Engineering Faculty,* *Universitas 17 Agustus 1945* *Surabaya, Indonesia* fitofirman1@gmail.com	The Role of Technical Drawings in the Industrial World

14.00 – 14.15	Haekal Ardy *Engineering Faculty,* *Universitas 17 Agustus 1945* *Surabaya, Indonesia* haekal.ardy8@gmail.com	Mundel: Understanding the Dynamics of a Complex System
14.15 – 14.30	Haekal Ardy *Engineering Faculty,* *Universitas 17 Agustus 1945* *Surabaya, Indonesia* haekal.ardy8@gmail.com	Unleashing the Power of OMAX: Exploring the Capabilities and Applications of a Cutting-Edge Material
14.30 – 14.45	Coffee Break	
15.00 – 16.00	Closing Ceremony	
16.00 – 18.00	Dinner	

4 October 2023 (Wednesday): Video Presentation

Date	**October 4, 2023**	
Time (UTC+7)	**General Presentation** **Session A – Video Presentation** **Platform: Zoom Meeting** **(Graha Wiyata Building, 1st Floor, Meeting Room)**	
V-P 1A	**Chairperson:** **Luvia Friska Nurulita, S.ST., M.T.**	
13.00 – 13.15	Dr. Sangeeta A. Nirmal, *(Chikitsak Samuha's Sir Sitaram and Lady Shantabai Patkar College of Arts and Science and V.P. Varde College of Commerce and Economics, Mumbai, India)* sangeetakanojia@gmail.com	A Study of Cobalt Atom Interaction with Single Walled Carbon Nanotube (8, 0): Using Density Function Theory
13.15 – 13.30	Dr. Watheq F. Shneen, (*Department of Physics, College of Science, University of Basrah, Basrah, Iraq)* wathaqf.gnaby@uokufa.edu.iq	Using Quantum Dot Structure and Suitable Material for Increasing Propagation Length of Surface Plasmon Polariton
13.30 – 13.45	Dr. A.V. Borodina *(Southern Federal University, Institute of Nanotechnologies, Electronics, and Equipment Engineering, Taganrog, Russia)* aborodi@sfedu.ru	Effect of Cobalt Oxide Content on Photoconductivity of Co_3O_4-ZnO Films
13.45 – 14.00	Dr. N.A. Kirgintsev, *Institute of Nanotechnologies, Electronics, and Equipment Engineering, Southern Federal University, Taganrog, Russia* aysoffc@gmail.com	Influence of Annealing Temperature of Al-ZnO Films on Their Photoconductivity
14.00 – 14.15	Prof. S.V. Dmitriev *Institute of Molecule and Crystal Physics, Ufa Federal Research Centre of the Russian Academy of Sciences, Ufa, Russia* dmitriev.sergey.v@gmail.com	Influence of the Environment on the Vibration Frequencies of a Cylindrical Shell
14.15 – 14.30	Dr. M.E. Nassar *Department of Physics and Engineering Mathematics, Faculty of Electronic Engineering, Menoufia University,*	Investigating the Equivalent Properties of a Porous Piezocomposite with Metalized Pores' Boundaries Using a Random Representative Volume Considering

	Menouf, Egypt MOHAMMED.ALSAYED75@el-eng.menofia.edu.eg	Heterogeneous Polarization
V-P 2A	**Chairperson:** **Dr. Andarita Rolalisasi**	
13.00 – 13.15	Adam Rival Adito Pramono *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia* adamriva@gmail.com	Analysis Productivity: Productivity Measurement with the Omax Method.
13.15 – 13.30	Abdullah Bandar *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia* abdullahbandar01tkr@gmail.com	Measurement and Efforts to Increase Productivity PT Biru Semesta Abadi Using Omax Method (Objective Matrix)
13.30 – 13.45	Amanda Tasya Kirana *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia* amandatasya142@gmail.com	Analysis of Bio-Oil Marketing Strategy in Sumenep
13.45 – 14.00	Arij Basmin Basmala *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia* arijbasminb@gmail.com	Basic Concepts for Decision Making Based on Uncertainty: Development of a Payoff Matrix
14.00 – 14.15	Allesandro Adam *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia* allesandroadm@gmail.com	Make an Ergonomic Desk
14.15 – 14.30	Bima Aulia Wahyu Agung *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia* Bimaauliawahyu99@gmail.com	Productivity Analysis Using Marvin E. Mundel Method (Study Case In CV.Gavra Perkasa)
V-P 3A	**Chairperson:** **Dian Setiya Widodo, ST, MT**	
13.00 – 13.15	Aldho Ferdinand *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia* veteranaldo33@gmail.com	Productivity Analysis of Marvin E. Mundel and Lean Manufacturing Applications (Case Study of PT. Abadi Water)
13.15 – 13.30	Aldiansyah Fiqri Setiana *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia* aldifiqri0@gmail.com	Coffee Bean Processing Analysis Using Objective Matrix (OMAX) Method (Case Study: Pt. Aneka Coffee Industry).
13.30 – 13.45	D.C. Chand *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia* chandcahyo25@gmail.com	Development of Food Recipes in Semaring Regional General Hospital
13.45 – 14.00	Handhika Mahindra Armadani *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia*	Implementation of the Use of AutoCad Applications in Improving Basic Competence in Engineering Drawing for the Community

	handhikaarmadani@gmail.com	
14.00 – 14.15	Helda Prisdana Hardinta *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia* helda.pris01@gmail.com	Productivity Measurement Using the Marvin E. Mundel Method: A Case Study in the PT. Tjakrindo Mas
14.15 – 14.30	Indah Nabu *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia* indahnabu@gmail.com	Productivity Analysis Using the Marvin E. Mundel Method (Case Study at UD. Sabar Jaya)
14.30 – 14.45	Coffee Break	
	General Presentation **Session B – Video Presentation** **Platform: Zoom Meeting** **(Graha Wiyata Building, 1st Floor, Meeting Room)**	
V-P 1B	**Chairperson:** **Dr. I Made Kastiawan, ST., MT.**	
14.45 – 15.00	Karina Rahmawati *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia* Karinarhmwti@gmail.com	Analysis of Work Achievement Weight and Productivity Index UD. Samudra Jaya Abadi with the OMAX Approach
15.00 – 15.15	Khoirul Anam *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia* mochkhoirulanam@gmail.com	Solving the Problem of Shipping Goods by Transportation Method
15.15 – 15.30	Maissha Rizky Maulana *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia* sangpengembara1922@gmail.com	Comparison of the Productivity of Seasoning Processing PT. Smart Furniture
15.30 – 15.45	Mohammad Nico Adriya *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia* mnicoadriya@gmail.com	Reducing Defect in the Production Process
15.45 – 16.00	Muhammad Azizul Hakim *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia* muhammadazizulh@gmail.com	Application of AHP Method for Supplier Selection
16.00 – 16.15	Satria Putra Samudera *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia* satriaputrasamudera@gmail.com	Productivity Analysis of the Production Division at PT. Jaya Tech Palmindo Using the Objective Matrix (OMAX) Method
V-P 2B	**Chairperson:** **Anang Pramono, S.Kom, MM.**	
14.45 – 15.00	Safina Dinara *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia*	Productivity Measurement Using the Marvin E. Mundel Method: A Case Study in the Flour Company

	safinadinara16@gmail.com	
15.00 – 15.15	Akilla Alfrets Deanoffa Gunawan *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* akilla1922@gmail.com	Application of the Analytical Hierarchy Method Menu Priority Determination Process (AHP), which was Developed in School Canteen X
15.15 – 15.30	Nafian Ramadhika Atviono *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* ramadhikanafian@gmail.com	Relevance Study of Engineering Drawing Course and Vocational High School Productive Subject of Engineering Drawing Major with Competency Test Standard
15.30 – 15.45	Satria Putra Samudera *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* satriaputrasamudera@gmail.com	Productivity Analysis of the Production Division at PT. Jaya Tech Palmindo Using the Objective Matrix (OMAX) Method
15.45 – 16.00	Rafi Arya Lingga Satya *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* Rafiarya28@gmail.com	Productivity Index Calculation Using American Productivity Center (APC) method at CV. Java Camera
16.00 – 16.15	Rafi Arya Lingga Satya *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* Rafiarya28@gmail.com	Combination of AHP and TOPSIS Methods in Decision Support Systems

5 October 2023 (Thursday): Video Presentation

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.Date	**October 5, 2023**	
Time (UTC+7)	**General Presentation** **Session C – Video Presentation** **Platform: Zoom Meeting** **(Graha Wiyata Building, 1st Floor, Meeting Room)**	
V-P 1C	**Chairperson:** **Maula Nafi, S. T., M.T.**	
10.45 – 11.00	Sani Zakiyah Maharani *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* smhrni22@gmail.com	Shipping Cost Effectiveness for Wood Pallet Companies Using Transportation Methods
11.00 – 11.15	Achmand Fuadi Priyo Mardani *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* achmadfuadipriyo12@gmail.com	Productivity Analysis Using the OMAX Method
11.15 – 11.30	Andiko Prasetyo *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* andikoprasetyo07@gmail.com	Comparison of the Productivity of Seasoning Processing PT. Daesang Food Indonesia and PT. Miwon
11.30 – 11.45	Amanda Tasya Kirana *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* amandatasya142@gmail.com	Supplier Selection Analysis of Metallic Box Using Fuzzy Analytic Hierarchy Process (AHP)

11.45 – 12.00	Allesandro Adam *Engineering Faculty,* *Universitas 17 Agustus 1945* *Surabaya, Indonesia* allesandroadm@gmail.com	Material Requirement Plan to Souvenir Master Production Schedule
10.45 – 11.00	Sani Zakiyah Maharani *Engineering Faculty,* *Universitas 17 Agustus 1945* *Surabaya, Indonesia* smhrni22@gmail.com	Shipping Cost Effectiveness for Wood Pallet Companies Using Transportation Methods
	General Presentation **Session D – Video Presentation** **Platform: Zoom Meeting** **(Graha Wiyata Building, 1st Floor, Meeting Room)**	
V-P 1D	**Chairperson:** **Izzah Aula Wardah., S.ST., M.EngSc.**	
13.00 – 13.15	Dr. G. A. Geguzina *Southern Federal University, Rostov on Don, Russia* geguzina@sfedu.ru	Change in Different Phase Transitions Temperatures of Binary Perovskites with a Change in Their Interatomic Bond Strains
13.15 – 13.30	Dr. K.V. Kolomiytsev *Southern Federal University, Institute of Nanotechnologies, Electronics, and Equipment Engineering, Taganrog, Russia* kirillvaleryevih@mail.ru	Stand for Measuring the Characteristics of the Photoconductivity of Semiconductor Oxide Films
13.30 – 13.45	Prof. L.P. Ichkitidze *Institute of Biomedical Systems, National Research University of Electronic Technology, MIET, Zelenograd, Moscow, Russia* ichkitidze@bms.zone	Behavior of Magnetic Nanoparticles in the Phantom of the Biological Medium
13.45 – 14.00	Prof. S.V. Dmitriev *Institute of Molecule and Crystal Physics, Ufa Federal Research Centre of the Russian Academy of Sciences, Ufa, Russia* dmitriev.sergey.v@gmail.com	Influence of the Environment on the Vibration Frequencies of a Cylindrical Shell
14.00 – 14.15	Dr. Chebanenko V. A. Federal Research Center "Southern Scientific Center of the Russian Academy of Sciences", Rostov-on-Don, Russia valera.chebanenko@yandex.ru	Delamination Detection in a Multilayer Carbon Fiber Reinforced Plate Based on Acoustic Methods: Numerical and Experimental Study
14.15 – 14.30	Dr. Chebanenko V. A. Federal Research Center "Southern Scientific Center of the Russian Academy of Sciences", Rostov-on-Don, Russia valera.chebanenko@yandex.ru	Applied Theory of Vibrations of a Composite Electromagnetoelastic Bimorph with Damping
V-P 2D	**Chairperson:** **Muhammad Firdaus, ST., M.Kom.**	
13.00 – 13.15	Bima Aulia Wahyu Agung *Engineering Faculty,*	Productivity Analysis Using Objective Matrix Method (Study Case in Bottle Drink Company)

	Universitas 17 Agustus 1945 Surabaya, Indonesia Bimaauliawahyu99@gmail.com	
13.15 – 13.30	Syahril Umam *Engineering Faculty, Universitas 17 Agustus 1945 Surabaya, Indonesia* syahrilumam@gmail.com	Determination of Management Strategy Based on Performance Prism and SWOT Analysis (Case Study at Travel Avatar Magetan)
13.30 – 13.45	Indah Nabu *Engineering Faculty, Universitas 17 Agustus 1945 Surabaya, Indonesia* indahnabu@gmail.com	Productivity Measurement and Analysis at PT. Three Manunggal Synthetic Industries Using the Objective Matrix (OMAX) Method
13.45 – 14.00	Satria Putra Samudera *Engineering Faculty, Universitas 17 Agustus 1945 Surabaya, Indonesia* satriaputrasamudera@gmail.com	Productivity Analysis Using Marvin E. Mundel Method (Study Case in PT. Multi Kusuma Cemerlang)
14.00 – 14.15	Moch Subhan Basri *Engineering Faculty, Universitas 17 Agustus 1945 Surabaya, Indonesia* subhanbasri.123@gmail.com	Measurement of Productivity in PT Citra Cakra Mahardika Using OMAX (Objective Matrix) Method
14.15 – 14.30	Muhammad Azizul Hakim *Engineering Faculty, Universitas 17 Agustus 1945 Surabaya, Indonesia* muhammadazizulh@gmail.com	Management of B3 and K3 Management Systems, PT. Ispat Indo
V-P 3D	**Chairperson:** **Intan Dzikria, S.Kom, M.IM., Ph.D.**	
13.00 – 13.15	Faricha Amarah Dhani *Engineering Faculty, Universitas 17 Agustus 1945 Surabaya, Indonesia* faricha.ad@gmail.com	Partial Productivity Measurement with the Mundel Method
13.15 – 13.30	Jean Audi Cahaya Nirwana *Engineering Faculty, Universitas 17 Agustus 1945 Surabaya, Indonesia* jejean0502@gmail.com	Engineering Drawing Reading Training for Sales and Production Teams at PT. X
13.30 – 13.45	Nafian Ramadhika Atviono *Engineering Faculty, Universitas 17 Agustus 1945 Surabaya, Indonesia* ramadhikanafian@gmail.com	Decision Making in Uncertain Conditions
13.45 – 14.00	Safina Dinara *Engineering Faculty, Universitas 17 Agustus 1945 Surabaya, Indonesia* safinadinara16@gmail.com	Productivity Measurement with the OMAX Method: A Case Study in the Flour Company
14.00 – 14.15	Willy Neilson Kaunang *Engineering Faculty, Universitas 17 Agustus 1945 Surabaya, Indonesia* willyneilsonkaunang09@gmail.com	Optimizing Productivity in Silky Pudding Industry: A Mundel Approach to Effective Management.
14.15 – 14.30	Muhammad Firdaus Al Amin, Arif Rahman Setyo Nugroho	Putting in Place a Method of Transportation to Deal with the Problem of Wood Pallet

	Engineering Faculty, *Universitas 17 Agustus 1945* *Surabaya, Indonesia* Firdausalamin29@gmail.com	Shipments
14.30 – 14.45	Coffee Break	
15.00 – 16.00	Closing Ceremony	
16.00 – 18.00	Dinner	

POSTER PRESENTATION

4 October 2023 (Wednesday): Poster Presentation

Chairperson : Dr. Tomy Michael, SH., MH.
Co-Chairperson : Dheny Jatmiko, S.Hum, MA.
Venue : Graha Wiyata Building (1st Floor)
Time (UTC+7) : 09.00 – 16.00

No.	**Authors - Affiliation**	**Report Title**
1	Dr. Andrey L. Nikolaev *Don State Technical University,* *Rostov-on-Don, Russia* andreynicolaev@eurosites.ru	Structure and Properties of DC Magnetron Deposited TiN and AlN Coatings with Different Stoichiometry.
2	Desti Sagita Sharren N *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia* destysharren@gmail.com	3D Drawing in Autodesk Inventor Software
3	Moh. Subhan Basri *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia* subhanbasri.123@gmail.com	Enhancement of Shrimp Pond Productivity for the Community of Karanganyar Village
4	Rajendra Razaan Un *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia* rendraun2@gmail.com	Food Processing Industry Shrimp Cracker Processing in Sudi Mampir Cracker.
5	Rafi Arya Lingga Satya *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia* Rafiarya28@gmail.com	Productivity Analysis in Assembly Department Using Objective Matrix (OMAX) Method in Labour Intensive Manufacturing
6	Rafi Arya Lingga Satya *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia* Rafiarya28@gmail.com	Productivity Index Calculation Using Mundel Approach Data at PT. Maju Jaya Berkah Abadi
7	Nur Muafiatul Farichah *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia* nurmuafiatul@gmail.com	The Importance of Drawing Engineering for Industrial Environment

8	Previa Syanindita *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* syaninditaprevia@gmail.com	Designing and Improving of Shoe Racks for Limited Space Storage Using AutoCAD Software
9	Ni Ketut Alit Paramita Diari *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* paramitadiari22@gmail.com	AutoCAD 3D Simulation to Increase Shoe Rack Design Efficiency
10	Willy Neilson Kaunang *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* willyneilsonkaunang09@gmail.com	OMAX Method for Productivity Measurement: A Case Study on Pudding Silky Company
11	Erni Puspanantasari Putri *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* erniputri@untag-sby.ac.id	Development of Java Coastal MSMEs Based on Blue Economy
12	Erni Puspanantasari Putri *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* erniputri@untag-sby.ac.id	Sustainable Blue Economy Development as an Effort to Improve East Java Province's Economic
13	Camelia Marcella *Department of Law,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* cameliamarcella55@gmail.com	Museum Management Used by the W.R. Soepratman Museum
14	Shadam Teja Kusuma *Department of Law,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* shadamkusuma43@gmail.com	Mechanism and Management of Compensation Policy for Environmental Pollution from Environmental Health Legal Perspective
15	Seza Aulia Gusti Kurnia *Department of Law,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* sezaaulia1205@gmail.com	Tunjungan Street as a Tourist Destination
16	Nikita Rafa Sahara *Department of Law,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* nikitarafa@gmail.com	Museum Olahraga Surabaya as the National Sport Archive
17	Maharani Dwi *Department of Law,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* maharanidwi2007@gmail.com	Strategy to Attract the Interest of Tourists to Visit Historical Places
18	Hardian Ardy Sengkey *Department of Law,* *Universitas 17 Agustus 1945 Surabaya, Indonesia*	Strategy for Development of Religious Tourism Potentials in Bukit Kasih Kanonang, Minahasa District
19	Fionna Farelita *Department of Law,* *Universitas 17 Agustus 1945 Surabaya, Indonesia*	Mpu Tantular Museum as a Cultural Heritage Tourism Attraction in East Java

	Fionna1092@gmail.com	
20	Fani Kurniawati *Department of Law,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* Fanikurniawati2309@gmail.com	Cluster Development of Small and Medium Manufactures in Surabaya City, East Java, Indonesia: Across the Limits of Time and Spaces
21	S.A. Ega Purnama *Department of Law,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* Egauntag123@gmail.com	Surabaya Sports Museum
22	Cecareno Gilbrani Anwar *Department of Law,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* renogilbrani25@gmail.com	Legal Certainty of Biography Museum
23	Andi Erza Achmad Raihan *Department of Law,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* andiraihan427@gmail.com	Mpu Tantular – State Museum of Indonesia in Sidoarjo
24	Adinda Isna Nabila *Department of Law,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* ilascreai@gmail.com	House of Hadji Oemar Said Tjokroaminoto

5 October 2023 (Thursday): Poster Presentation

Chairperson : Dr. Tomy Michael, SH., MH.
Co-Chairperson : Dheny Jatmiko, S.Hum, MA.
Venue : Graha Wiyata Building (1st Floor)
Time (UTC+7) : 09.00 – 16.00

	Authors - Affiliation	**Report Title**
1	Abdullah Bandar *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* abdullahbandar01tkr@gmail.com	Segunung Hamlet Potential Innovation Traditional Village, Tourism and Economy Local Community
2	D.C. Chand *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* chandcahyo25@gmail.com	Investment In Tailor Village
3	Karina Rahmawati *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya, Indonesia* Karinarhmwti@gmail.com	Energy and Waste Integrated Food Security-Based Climate Village Program in Kebonsari Village Towards Sustainable Proklim Village Surabaya
4	Seftia Aulia Putri *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya, Indonesia*	Designing and Improvement of Drinking Bottles for Storing Liquids

	seftiaaulia2002@gmail.com	
5	Muhammad Dikri Firnanda *Engineering Faculty,* *Universitas 17 Agustus 1945 Surabaya,* *Indonesia* dikriracun1@gmail.com	Using the AHP (Analytic Hierarchy Process) Method to Determine the Seafood Menu 88
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