LUTSK NATIONAL TECHNICAL UNIVERSITY

MATERIALS TECHNOLOGY ENGINEERING 2023

International Conference on **Engineering, Materials, Technologies, Transport**

May 16-18, 2023 | Lutsk, Ukraine

Conference program

Authors:
Oleksandr Povstyanoy, Olha Zaleta, Bohdan Valetskyi

Lutsk National Technical University

Materials and Technologies in Engineering (MTE-2023): Engineering, Materials, Technologies, Transport: Conference program of the International Conference, Lutsk, Ukraine, May 16-18, 2023 / Oleksandr Povstyanoy, Olha Zaleta, Bohdan Valetskyi. – Lutsk, 2023 – 116 p.

This collection presents abstracts of the speeches of the participants of the International Scientific and Technical Conference MTE-2023, which took place on May 16-18 in Lutsk, at the Lutsk National Technical University. This collection contains general information about the experience and deepening of knowledge in the structure, properties, technologies of obtaining metal, composite, ceramic, polymer and powder materials in engineering. The materials of the scientific discussions are devoted to modern research and prospects for the development of mechanical engineering as a whole and to new strategies for the development of road transport in particular.

CONTENT

ABOUT MTE-2023

The International Scientific and Technical Conference **MTE-2023** provides a platform for domestic and international engineering standards, where you can discuss and share your advanced, progressive, and key achievements, exchange information, experience, and knowledge about the structure, properties, technologies for obtaining metallic, composite, ceramic, polymeric, and powder materials in engineering, obtaining new types of products using computer modeling and the latest information technologies.

In addition to presentations, seminars, and discussions, **MTE-2023** also offers a unique scientific platform for restoring professional partnerships, establishing connections, and staying up-to-date with the latest trends in engineering. Scientific discussions will also be dedicated to modern research and prospects for the development of mechatronics, mechanical engineering as a whole, and new strategies for the development of automotive transport in particular.

The International Scientific and Technical Conference **MTE-2023** also includes discussions on issues related to the use of Industry 5.0 principles in various engineering fields, including machine and instrument manufacturing, automotive industry, and materials science.

The peculiarities of conducting scientific research in Ukraine in conditions of martial law deserve respect and support from the international community. Productive and constructive work, in the name of our health and preservation of our patriotic youth's spirit, will only contribute to the development of Ukraine and science in particular.

The organizing committee of **MTE-2023** sincerely welcomes conference participants and is confident in an interesting, scientific, and useful work, confident in peace for us in the future and in Ukraine's victory.

VENUE

Lutsk is one of the oldest cities in Ukraine. The first mention of Lutsk dates back to 1085 in the Ipatiev Chronicle, when the city became the center of the internecine struggle of the descendants of Yaroslav Mudry.

Lutsk is a fantastic city that you want to visit and infinitely want to return to. Here, the past and the present are closely intertwined, you can still hear echoes of knightly tournaments, rebel songs are sung, local residents are called Luchanians, Lesya Ukrainka once walked the streets here, good music sounds, heroes are born here, there is delicious cuisine and a peaceful pace of life.

Lutsk is the place where Europe begins.

On the southern outskirts of the ancient and forever young city of **Lutsk**, its unique satellite town has spread its buildings, which attract attention not only for their architectural and aesthetic beauty, but also for their attractiveness. For generations, thousands of young men and women have brought their most cherished dreams here. In this one of the best temples of science not only in the blue-eyed Volyn region, but also in the entire western region of Ukraine, the finest grains of their destiny are sown, which later grow into a bountiful harvest of knowledge, self-affirmation, and self-expression. From here, their distant and close roads begin, leading to a "wide, free, and new" world.

The following principles were laid at the foundation of the activities of the **Lutsk National Technical University:**

- Comprehensive and thorough study of the contingent of prospective youth, identification of their abilities, inclinations, and preferences;
- Thoroughness and fundamental nature of education at the university level;
- Direct involvement of renowned experts, managers of enterprises, organizations, and business structures in the educational process, strengthening the links between education, theoretical enrichment of students with the development of practical, including production, skills.
- Targeted individual work with students, instilling in youth high moral and patriotic qualities, boundless love for independent, sovereign Ukraine.

427 scientific and pedagogical workers are employed at **the Lutsk National Technical University**, 90% of whom have scientific degrees, including 342 PhDs and associate professors, 37 doctors of science and professors, 15 academicians and members of industry academies, 3 distinguished education workers of Ukraine and 3 distinguished scientists and technicians of Ukraine. Each of them has their own character, lifestyle,

behavior, and approaches to solving current problems. This spectrum of diversity cements and enriches the university as a single organism, making it mobile, vital, and capable.

The vast majority of teachers and scientists at **LNTU** are gifted, knowledgeable professionals with significant teaching abilities and life experience.

LNTU's cooperation with educational institutions and establishments of other countries is based on the principles of prioritizing national interests, developing the university's educational and scientific potential, and mutually beneficial cooperation, with a focus on attracting additional sources of funding through grant systems and agreements with foreign legal and physical entities regarding student education and training of scientific personnel.

The international cooperation of **Lutsk National Technical University** is aimed at integrating the higher education institution into the European and global educational and scientific space, being an integral part of its activities that corresponds to the recommendations of the Ministry of Education and Science of Ukraine regarding the internationalization of higher education.

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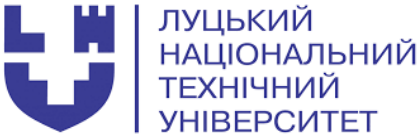
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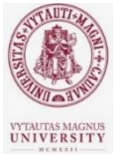
VYTAUTAS MAGNUS
UNIVERSITY


AC2T
research


ISM


УМТ


ІВАНО-ФРАНКІВСЬК


НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ
«ЧЕРНІГІВСЬКА ПОЛІТЕХНІКА»


ТНТУ


ЛЬВІВСЬКА ПОЛІТЕХНІКА


ВІННИЦЬКИЙ НАЦІОНАЛЬНИЙ ТЕХНІЧНИЙ УНІВЕРСИТЕТ
ВНТУ
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1978


Національний технічний університет України імені Ігоря Сікорського

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Baglyuk Gennadii, Corresponding Member, D.Sc., Institute of Materials Science Problems I.M. Frantsevich National Academy of Sciences, Kiev, Ukraine

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Stupnytskyy Vadym, D.Sc., Professor, Lviv Polytechnic National University, Lviv, Ukraine

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Posuvailo Volodymyr, Ph.D., Associate Professor, Physico-Mechanical Institute G.V. Karpenka of the National Academy of Sciences of Ukraine, Lviv, Ukraine

Slabkyi Andrii, Ph.D., Associate Professor, Vinnytsia National Technical University, Vinnytsia, Ukraine

Zabolotnyi Oleg, Ph.D., Associate Professor, Lutsk National Technical University, Lutsk, Ukraine

Selivonchyk Tetyana, Ph.D., Associate Professor, Kovel Industrial and Economic College, Kovel, Ukraine

Vasiliev Oleksandr, Ph.D., Associate Professor, Institute for Problems of Materials Science National Academy of Sciences, Kiev, Ukraine

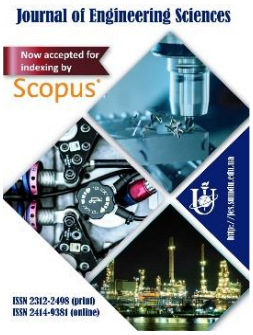
ORGANIZATIONAL COMMITTEE

Redko Rostyslav, Ph.D., Associate Professor, Lutsk National Technical University, Lutsk, Ukraine - the main manager of the organizing committee
Murovanyi Igor, Ph.D., Associate Professor, Lutsk National Technical University, Lutsk, Ukraine
Onyshchuk Vasyl, Ph.D., Associate Professor, Lutsk National Technical University, Lutsk, Ukraine
Puts Vitalii, Ph.D., Associate Professor, Lutsk National Technical University, Lutsk, Ukraine
Chetverzhuk Taras, Ph.D., Associate Professor, Lutsk National Technical University, Lutsk, Ukraine
Polinkevich Roman, Ph.D., Associate Professor, Lutsk National Technical University, Lutsk, Ukraine
Valetskyi Bohdan, Ph.D., Associate Professor, Lutsk National Technical University, Lutsk, Ukraine
Zaleta Olha, Ph.D., Associate Professor, Lutsk National Technical University, Lutsk, Ukraine
Rusakov Denis, Assistant, Kovel industrial and economic professional college, Kovel, Ukraine
Bychyk Vitaliy, graduate student, Lutsk National Technical University, Lutsk, Ukraine

CONFERENCE TOPICS

1. Physical, chemical, technological properties of materials and their structure.
2. Technologies for obtaining new materials.
3. Computer modeling and information technology in engineering.
4. Design of mechatronic systems.
5. Modern research and prospects for the development of mechanical engineering.
6. Strategies and modern technologies in road transport.

PROCEEDINGS OF THE CONFERENCE



AGENDA

Day 1, May 16, Tuesday

9^{00}-10^{00} **Registration**

10^{00}-10^{15} **Opening of the conference. Welcome speech: LNTU as a scientific platform and cooperation platform,** Conference Leader, Rector of LNTU, Professor IRINA VAKHOVYCH (Lutsk National Technical University, Ukraine)

10^{15}-10^{30} **Scientific cooperation through the prism of international and domestic partnership of LNTU employees with leading scientists**, Conference Manager, Professor OLEKSANDR POVSTYANOY (Lutsk National Technical University, Ukraine)

10^{30}-11^{00} **Diatoms shells as strengthening elements of composite materials**, Professor KRZYSZTOF JAN KURZYDŁOWSKI (Bialystok University of Technology, Poland)

11^{00}-11^{30} **Engineering interpretation of the XXI Century signals**, Professor LUÍS FRÖLÉN RIBEIRO (Bragança Polytechnic Institute, Portugal)

11^{30}-12^{30} **Scientific coffee. Backstage discussions and debates**.

12^{30}-13^{00} **Material Science in High Energy Physics Experiments**, Professor VINCENZO BERARDI (Politecnico di Bari, Italy)

13^{00}-13^{30} **The strength and accuracy of lead screws - as a function of the geometry of the cutting tool, or out-of-standard views on the formation of helical surfaces**, Professor ONYSKO OLEH, (Ivano-Frankivsk National Technical University of Oil and Gas, Ivano-Frankivsk, Ukraine)

13^{30}-14^{00} **Informal discussions and exchange of views**.

14^{00}-16^{00} **LNTU as a scientific platform: tour, overview, presentations**.

17^{00}-22^{00} **Gala Dinner**

Day 2, May 17, Wednesday

10^{00}-10^{30} **Ceramic bio-coatings on titanium alloys: surface morphology, chemical composition**, Ph.D., associate professor NATALIIA IMBIROVYCH (Lutsk National Technical University, Ukraine)

10^{30}-11^{00} **Problems of using modern structural materials in domestic engineering**, Ph.D., associate professor ANDRII SLABKYI (Vinnytsia National Technical University, Ukraine)

11^{00}-11^{30} **Synthesis of structures for automatic clamping mechanisms with extended technological capabilities**, Ph.D., associate professor BORYS PRYDALNYI (Lutsk National Technical University, Ukraine)

11^{30}-12^{00} **Efficiency of processing components of tribotechnical epoxy composites with physical fields**, Ph.D., professor VITALII KASHYTSKYI (Lutsk National Technical University, Ukraine)

12^{00}-12^{30} **Study of Parameters of the Mixture and Heat Generation of the DD15 Diesel Engine of the Sandvik LH514 Loader in the Process of Using Alternative Fuels Based on RME,** Ph.D., Associate Professor, VASYL MELNYK, (Ivano-Frankivsk National Technical University of Oil and Gas, Ivano-Frankivsk, Ukraine)

12^{30}-13^{00} **Functional Shape Memory Cu-Al-Mn Alloys, Ph.D.,** Senior Researcher, IRINA BUBLEY, (G.V. Kurdyumov Institute for Metal Physics NASU, Kyiv)

13^{00}-13^{30} **Current Trends for Functional Shape Memory Medical Materials** Ph.D., SERGII KEDROVSKYI, (G.V. Kurdyumov Institute for Metal Physics NASU, Kyiv)

13^{30}-14^{30} **Scientific lunch.**

14^{30}-17^{00} **Educational tour of historical places of Lutsk**

Day 3, May 18, Thursday

10^{00}-12^{00} **Discussion of section reports.**

12^{00}-14^{00} **Closing the conference. Summary and discussion of future scientific plans**, Conference Manager, D.Sc, Professor OLEKSANDR POVSTYANOY (Lutsk National Technical University, Ukraine)

MAIN SPEAKERS

OLEKSANDR POVSTYANOY
Professor
Department of Applied Mechanics and Mechatronics,
Lutsk National Technical University, Ukraine

MATERIALS TECHNOLOGY ENGINEERING 2023

Keynote Speech Topic

Scientific cooperation through the prism of international and domestic partnership of LNTU employees with leading scientists

The main strategic principle of the international and scientific activity of the Lutsk National Technical University is the internationalization of its educational and scientific activity as a basis for integration into the international educational and scientific space and as a means of establishing itself in the international arena.

Lutsk National Technical University annually increases its scientific indicators of efficiency and prestige in international and Ukrainian rankings. For the second year in a row, the war in Ukraine affected all the processes taking place in our country. New extremely difficult challenges have also appeared before the science of Ukraine.

Today, LNTU is in the rear, we are in relative safety and we are trying to use this opportunity and do our best to support scientists.

That is why this year we are launching a new international conference to attract domestic and international partners to the scientific space of Ukraine. And the most important thing is to help our Ukrainian youth to obtain high-quality scientific results and establish themselves in life, to find their place in the great world of opportunities.

KRZYSZTOF JAN KURZYDŁOWSKI
Professor
Department of Materials Engineering and Production,
Faculty of Mechanical Engineering,
Bialystok University of Technology,
Poland

MATERIALS TECHNOLOGY ENGINEERING 2023

Keynote Speech Topic

Diatoms shells as strengthening elements of composite materials

Over last decades diatoms shells, so called frustules, attracted a lot of attention of materials scientists because of their unique architecture and properties. These shells, built with bio-silica synthesized by diatoms, might have size ranging from a few to hundreds of microns.

The work presented was focused on empirical and numerical investigations of the interlocking of diatom shells with metal/polymer matrices. PLA, Al, Mg and Ti composites with diatom earth were investigated. Finite Element Modelling was carried out to explain properties of fabricated composites. Results have been used to select most promising types of diatoms for modification of given polymeric or metallic matrix.

LUÍS FRÖLÉN RIBEIRO
Professor
Head of Department at Instituto Politécnico de Bragança,
Bragança Polytechnic Institute,
Portugal

MATERIALS TECHNOLOGY ENGINEERING 2023

Keynote Speech Topic

Engineering interpretation of the XXI Century signals

In the Western world, the main concerns are related to sustainability. Implementing a Circular Economy is a way of executing humanity's vision towards a sustainable future. There are different interpretations of Circular Economy, and current players often misinterpret it simply with recycling. Although no conclusive definition exists, all interpretations prune towards an ideal case of zero waste society. Instead, waste is replaced by by-products spun from the industrial process.

This interpretation is often applied to a product chain in a transformation line. However, more attention should be given to machine design, encouraging circularity in the conception of the machine and its parts. That is a premium that consumers are willing to pay, which is becoming increasingly common in the Western world. Engineers should address the products and machines' circularity, designing for re-usability or up-cycling at the end of their life. Engineering Schools soon will have to address these issues in their curricula.

VINCENZO BERARDI
Professor
Associate Professor of Experimental Physics,
PhD in Physics at FEDERICO II University of Naples (Italy)
Interuniversity Department of Physics "M.Merlin"
Politecnico di Bari,
Italy

MATERIALS TECHNOLOGY ENGINEERING 2023

Keynote Speech Topic

Material Science in High Energy Physics Experiments

High Energy Physics (HEP) experiments are the results of up to ten years of planning and design. Material Science has a fundamental role in such planning. In this communication examples of the importance of material science in such "big physics experiment" will be presented.

OLEH ONYSKO
professor
Department of Computerized Mechanical Engineering,
National Technical University of Oil and Gas,
Ukraine

MATERIALS TECHNOLOGY ENGINEERING 2023

Keynote Speech Topic

The strength and accuracy of lead screws - as a function of the geometry of the cutting tool, or out-of-standard views on the formation of helical surfaces.

Shaping of lead-screws is a well-known process of forming a surface, which according to all existing standards is directly or indirectly defined as an Archimedean helicoid. This means that the technical drawing of the lead-screw contains its axial section, from which their classification in terms of profile shape follows: rectangular, trapezoidal, thrust.

Such an out-of-standard approach to the nature of lead screws requires the determination of the axial profile of the convolute screw in functional dependence on the diameter of the part, the geometric parameters of the cutting edge, as well as the tangential deviation of the setting of the cutting tool and its subsequent comparison with the specified standard thread profile. In the case of acceptable deviations, the use of such a high-performance threading tool is a priority. If significant deviations are obtained, a new profile of the cutting edge of the tool should be determined, which does not correspond to the profile of the given lead screw, but is a function of its geometric parameters, installation deviations and the diameter of the part.

ABSTRACTS

Andrukh Yulia
Vorobyova Victoria

National Technical University of Ukraine
«Igor Sikorsky Kyiv Polytechnic Institute»
37, Prospect Peremohy, 03056, Kyiv-56, Ukraine

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Production of Silver Nanoparticles from Grape Pomace Extract Obtained by LES (Low-temperature Eutectic Solvent)

In this work, the "green" method of obtaining silver nanoparticles from grape pomace extract obtained by LES (low-temperature eutectic solvent) is considered. Due to the reducing and stabilizing properties of the extract, it is possible to obtain a nanosize from a silver salt solution. Nanoparticles were characterized by UV spectroscopy and SEM.

Corresponding author:
Andrukh Yulia (andrukh1805@gmail.com)

Anopko Dmytro, Ph.D., Associate professor
Honchar Olha, Ph.D., Associate professor
Kochevykh Maryna, Ph.D., Associate professor
Kushnierova Lilia, Ph.D., Associate professor

Kyiv National University of Construction and Architecture,
31, Povitroflotsky Av., Kiev, 03680, Ukraine

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Materials for Protection Against Electromagnetic Radiation

Existing shielding materials differ in composition and structure. Metallic materials have high conductivity, and materials of the iron subgroup also have magnetic properties. They are distinguished by high efficiency at radio frequencies and manufacturing technology - there are solid and perforated, in the form of sheets of mesh, or coatings. But metal screens have a high reflection coefficient, which is associated with high electrical conductivity of metals. To shield electromagnetic waves by absorbing radiation, it is advisable to use electrically conductive materials containing carbon or composite materials. One of the most promising areas of shielding is the use of metal- and carbon-filled mortars and concretes. They differ in the required mechanical characteristics, and also allow you to realize partial absorption of EMR due to the peculiarities of the material structure.

Corresponding author:
Dmytro Anopko (anopko.1973@gmail.com)

Bembenek Michał [1], D.Sc., Professor
Melnyk Vasyl [2], Ph.D., Associate Professor
Mosora Yurii [2]

[1] *AGH Akademia Górniczo-Hutnicza, AGH University of Science and Technology*, al. A. Mickiewicza 30, 30-059 Krakow, Poland;

[2] *Ivano-Frankivsk National Technical University of Oil and Gas,* 15, Karpatska St, Ivano-Frankivsk, 76019, Ukraine

SECTION: *Modern research and prospects for the development of mechanical engineering.*

Study of Parameters of the Mixture and Heat Generation of the DD15 Diesel Engine of the Sandvik LH514 Loader in the Process of Using Alternative Fuels Based on RME

Today, there is a growing shortage of commercial motor fuels in the world. This is due to the tendency to regulate hydrocarbon production, which is the main raw material for their production. And, therefore, in order to reduce the import of oil, today alternative types of fuel for diesel engines based on oils and animal fats are becoming widespread. In this regard, intensive work is underway to convert internal combustion engines to biofuel both in countries with limited fuel and energy resources and in highly developed countries that have the opportunity to purchase liquid energy carriers. Biodiesel fuel (biodiesel, RME, RME, FAME, EMAG, etc.) is an environmentally friendly type of biofuel obtained from vegetable and animal fats and used to replace petroleum diesel fuel. According to the results of modeling, in the process of using RME B100 biodiesel fuel, we found a reduction in nitrogen dioxide emissions by 21.5% and a reduction in soot emissions by 34.5%. This will positively affect the environmental performance of the Sandvik LH514 loader, which is especially relevant in closed environments such as mines.

Corresponding author: Bembenek Michał (bembenek@agh.edu.pl)

Bovnegra Liubov [1], Ph.D., Associate Professor
Strelbitskyi Viktor [2], Ph.D., Associate Professor

[1]*Odessa National Polytechnic University*,
1, Shevchenko St., Odesa 65044, Ukraine;

[2]*Odessa National Maritime University*,
34, Mechnikova St., Odesa, 65029, Ukraine

SECTION: *Computer modeling and information technology in engineering.*

Investigation of the Operational Reliability of Crane Hooks by Statistical Modeling

Port cranes are widely used for movement from one position to another and cargo loading onto a ship. Cranes are highly dangerous objects. One of the important components of the crane is the hook suspension. Cranes are highly dangerous objects. One of the important components of the crane is the hook suspension. This works analyses and evaluates the technical system reliability of crane hooks by statistical modeling. For research 60 portal cranes hooks were selected. The crane hooks surveys were carried out twice a year for 4 years. Analysis of studies showed that the most dangerous defects are cracks in the hooks, which lead to premature failure. These cracks could not be detected by visual inspection without dismantling the hook, since they were under the nut. After analyzing the data obtained using Microsoft Excel 2010 and calculating statistical characteristics, it was found that the operating time for failure generally corresponds to an exponential distribution.

Corresponding author:
Strelbitskyi Viktor (vict141174@gamil.com)

Bozhko Tetiana, Ph.D., Associate Professor
Samchuk Liudmyla, Ph.D., Associate Professor
Halyna Herasimchuk, Ph.D., Associate Professor

Lutsk National Technical University,
75, Lvivska St., Lutsk, 43018, Ukraine

SECTION: *Modern research and prospects for the development of mechanical engineering.*

Investigation of Dimensional Relationships in the Process of Abrasive Processing of Porous Materials

The interaction of the part with the grinding wheel, the formation of the roughness of the processed surface depending on the processing modes, the characteristics of the tool and a number of physical and mechanical properties of the materials were studied. An equation was obtained that characterizes the balance of movement in the technological system, which allows you to calculate the value of the vertical feed of the machine.

Corresponding author:
Bozhko Tetiana (t_bozhko@ukr.net)

Bubley Irina, Ph.D., Senior Researcher
Koval Yuri, D.Sc., Professor Corresponding Member of the NAS of Ukraine
Sych Tetyana, Ph.D., Senior Researcher

G.V. Kurdyumov Institute for Metal Physics of the National Academy of Sciences of Ukraine
36, Academician Vernadsky Boulevard, UA-03142 Kyiv, Ukraine

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Functional Shape Memory Cu-Al-Mn Alloys

The results of the study of alloys of the Cu-Al-Mn system with the shape memory effect during the martensitic transformation are presented. Our research made it possible to systematize the data on the temperature of the beginning of the direct martensitic transformation, which facilitates the selection of the materials composition necessary for solving certain technical tasks. The use of our results allows you to choose the composition of a precision functional alloy accurately and with minimal costs.

Corresponding author:
Bubley Irina (bubley@imp.kiev.ua)

Chernovol Michailo, D.Sc., Professor
Shepelenko Ihor, D.Sc., Professor
Mahopets Sergii, Ph.D., Associate Professor

Central Ukrainian National Technical University,
8, University Ave., Kropyvnytskyi, 25006, Ukraine

SECTION: *Modern research and prospects for the development of mechanical engineering.*

Restoring and Strengthening Machine Parts with Wear-resistant Coatings

The article considers the classification of coatings widely used in mechanical engineering for restoring and strengthening parts. The technological capabilities of external and internal coatings are analysed. The features of the formation of metal and non-metallic coatings are indicated. It is emphasised that wear-resistant coatings are of practical importance for the restoration and strengthening of parts. The analysis of their capabilities allowed us to assert the expediency of using coatings obtained by surfacing and sputtering. The effectiveness of coating formation by combined processing is indicated.

Corresponding author:
Shepelenko Ihor (kntucpfzk@gmail.com)

Chornoivanenko Kateryna, Ph.D., Associate Professor

Ukrainian State University of Science and Technologies,
2, Lazaryana St., Dnipro, 49010 Ukraine

SECTION: *Technologies for obtaining new materials.*

Patterns of Structure Formation at Carburization of Vanadium Alloys in Isothermal Conditions

Possibilities of improving the structure of vanadium alloys are considered. Structure formation during the carburization of iron alloys doped with vanadium was investigated. That leads to the growth of austenite-carbide directional structures, which represent a natural composite, under certain concentration and temperature conditions. The use of the phase reaction α → γ + VC in the carburization of vanadium alloys for the formation of austenite-carbide colonies in the surface layer has been studied. The possibility of strengthening carburized Fe-V alloys during the formation of bainite structures was shown. It was established that the most favorable for carburization is steel containing 1.75% V, its carburization at a temperature 1100 ºC for 3 hours ensures the hardness of the surface working layer with a thickness of 2...3 mm at the level of 66 HRC.

Corresponding author:
Chornoivanenko Kateryna (ekatmovchan@gmail.com)

Dembitskyi Valerii, Ph.D., Associate Professor
Murashko-Suprunyuk Nazarii

Lutsk National Technical University,
75, Lvivska St., Lutsk, 43018, Ukraine

SECTION: *Strategies and modern technologies in road transport.*

Effective Methods of Inventory Management at Service Stations

Inventory management is a large aspect of the effective operation of a service station. In order to ensure the availability of some stocks and reduce the costs of their maintenance, it is necessary to use effective methods of stock management. Various methods of inventory formation are proposed, such as the reorder point method, the ABC analysis method, the demand forecasting method, and others. For a small service station, the reorder point method can be the most effective, which allows you to reduce the number of stocks and control them in real time. However, when choosing a method, it is necessary to meet the specifics of the service station and its need for spare parts.

Corresponding author:
Dembitskyi Valerii (dvm2@meta.ua)

Dembitskyi Valerii, Ph.D., Associate Professor
Karaim Volodymyr

Lutsk National Technical University,
75, Lvivska St., Lutsk, 43018, Ukraine

SECTION: *Strategies and modern technologies in road transport.*

Car Service Station Management

Managing a car service station requires a comprehensive approach and attention to each department. To ensure the effective operation of units, it is necessary to clearly define the duties and responsibilities of each employee, use modern technologies and software tools to optimize work processes and improve the quality of service provision, ensure the appropriate level of material and technical condition, and it is important to take into account the financial stability of the enterprise. containers This approach makes it possible to achieve high quality of technical service and satisfaction of customer needs.

Corresponding author:
Dembitskyi Valerii (dvm2@meta.ua)

Demchenko Valeriy [1], D.Sc., Professor, Senior Researcher
Hnatyuk Tetiana [2], Junior Researcher
Zaremba Polina [2]

[1] *Institute of Macromolecular Chemistry of the National Academy of Sciences of Ukraine*,
48, Kharkivs'ke shose St., Kyiv, 02160, Ukraine;

[2] *D.K. Zabolotny Institute of Microbiology an Virology of the National Academy of Sciences* of Ukraine,
154, Akademika Zabolotnogo St., Kyiv, 03143, Ukraine

SECTION: *Technologies for obtaining new materials.*

Silver-containing Nanocomposites Based on Natural Polymers

Synthesized silver-containing nanocomposites of Na-carboxymethylcellulose–Ag–chitosan of low, medium, and high molecular weight by spraying silver nanoparticles on the surface of polyelectrolyte complexes.

Corresponding author:
Demchenko Valeriy (dvaleriyl@ukr.net)

Denysiuk Viktor, Ph.D., Associate Professor
Yablonsky V.V.
Chernyak S.O.

Lutsk National Technical University,
75, Lvivska St., Lutsk, 43018, Ukraine

SECTION: *Computer modeling and information technology in engineering.*

Analysis of Scanning Probe Lithography Techniques for Obtaining Masks in Polymer Films of Polymethyl Methacrylate

The analysis of techniques and methods of scanning probe lithography for the formation of lithographic masks for the subsequent production of nanoparticles with different aspect ratios, as well as metal nano-sized wires, both individually located and with massive contacts of the same or different metals, was carried out. It was established that the method of point indentation with feedback enabled is the most optimal when creating a lithographic mask for the formation of round nanoparticles when the thickness of the polymethyl methacrylate film is less than 100 nm using special diamond probes. With thicker polymer films, the shape of the resulting mask is distorted due to the design features of the device.

Corresponding author:
Denysiuk Viktor (v.denysiuk@lntu.edu.ua)

Denysiuk Viktor, Ph.D., Associate Professor
Chernyak S.O.
Yablonsky V.V.

Lutsk National Technical University,
75, Lvivska St., Lutsk, 43018, Ukraine

SECTION: *Computer modeling and information technology in engineering.*

Increasing the Accuracy of the System of Precision Movement of the Scanner of the Scanning Probe Microscope

Presents the results of studies of a piezoelectric scanner for precision mechanical movements in a scanning probe microscope with capacitive displacement sensors and image processing methods. The choice of a capacitive sensor with a variable gap between the covers, due to high accuracy and sensitivity, simple and cheap design, as well as minimal nonlinear distortions introduced into the SPM. Estimation of control parameters, obtained using a mathematical model of SPM, allowed to design a PID controller that provides precise mechanical movement with a given accuracy. The developed method of measurement and information processing is able to track the effects of dill, hysteresis and other nonlinearities of piezoceramics. It does not depend on the influence of temperature noise, the effects of changing the parameters of the scanner over time.

Corresponding author:
Denysiuk Viktor (v.denysiuk@lntu.edu.ua)

Dzenzerskiy Viktor, D.Sc., Professor
Tarasov Serhiy, Ph.D., Senior Researcher
Ivanov Volodymyr, Ph.D., Senior Researcher
Sukhova Olena, D.Sc., Professor

Institute of Transport Systems and Technologies of the National Academy of Sciences of Ukraine,
5, Pisarzhevsky St., Dnipro, 49005, Ukraine

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Mechanical Properties of Pb–Sn–Ba Grid Alloys for Lead-acid Batteries Produced by Melt Spinning Method

New approach to conventional manufacture technologies for the Pb–Sn–Ba grids of lead-acid batteries that involves two roll melt spinning process has been proposed in this work. The technology provides rapid cooling at a rate of $3.8 \cdot 10^5$ K/s from 425 °C to room temperature to ensure structural stability and to develop suitable microstructure of the battery grids with enhanced mechanical properties at high service temperatures of up to 80 °C.

In the as-quenched state, microstructure of the lower and higher barium content Pb–Sn–Ba grids, prepared at various tin contents, consists of uniform grains of a supersaturated lead-based solid solution. The addition of barium enhances tensile strength and hardness of the battery grids, while the addition of tin increases their elongation to failure. Besides, the tensile strength and hardness of the battery grids significantly increase during first 24 hours of age-annealing at 80 °C. With annealing time prolonging up to 3200 hours, the mechanical characteristics remain almost unchanged.

Corresponding author:
Sukhova Olena (sukhovaya@ukr.net)

Dzhala Roman, D.Sc., Senior Researcher
Dzhala Vasyl', Ph.D., Senior Research Fellow
Velnyk Mar'yan, Ph.D., Junior Research Fellow

Karpenko Physico-Mechanical Institute of the National Academy of Sciences of Ukraine,
5, Naukova St., Lviv, 79060, Ukraine

SECTION: *Physical, chemical, technological properties of materials and their structure.*

The Influence of Medium Conductivity on the Electrical Capacity of the Metal Surface Layer

To determine the physical and chemical properties and diagnose metal corrosion, the dependence of the capacitance of the metal surface on the frequency of the field, the electrical conductivities of the medium and the insulating coating was investigated. It is shown that at low electrical conductivity of the medium and at low field frequency, the capacitance values determined by known formulas must be refined.

Corresponding author:
Dzhala Roman (dzhala.rm@gmail.com)

Falchenko Yurii [1], D.Sc., Senior Scientist
Mykhailov Leonid [2], Ph.D., Senior Researcher
Fedorchuk Viktor [1], Ph.D., Senior Researcher
Petrushynets Lidiia[1], Ph.D., Senior Researcher

[1] *E.O.Paton Electric Welding Institute of the National Academy of Sciences of Ukraine,*
11, K. Malevycha St, Kyiv, 03150, Ukraine;

[2] *Institute for Nuclear Research of the National Academy of Sciences of Ukraine*
47, prospekt Nauky, Kyiv, 03028, Ukraine

SECTION: *Technologies for obtaining new materials.*

Development of a Welding Technology for Producing a Target to Obtain the ^{22}Na Isotope

Research on diffusion welding in a vacuum of magnesium MA2-1 with alumi-num alloy AMg2 was carried out. The influence of welding temperature and an intermediate layer of zinc on the formation of the joint zone was determined. Metallographic studies of welded joints were conducted. It was found that during direct welding of the MA2-1 alloy with AMg2 in the joint zone, as a result of mu-tual diffusion brittle intermetallic layers are formed, which leads to cracking of the joints. It is shown that the use of a zinc layer and a decrease in welding tempera-ture from 420 ºC to 340 ºC makes it possible to obtain welded joints without the formation of eutectic or brittle intermetallic layers in the joint. Based on the con-ducted research, bimetallic targets were obtained, which consist of a strip of mag-nesium irradiated with protons, and a water-cooled aluminum alloy chamber that is welded to it.

Corresponding author:
Lidiia Petrushynets (moremia2@ukr.net)

Feshchuk Yuriy, Ph.D., Associate Professor
Rybalchenko Vitalii, Postgraduate
Kashytskyi Vitalii, Ph.D., Professor
Melnychuk Mykola, Ph.D., Associate Professor

Lutsk National Technical University,
75, Lvivska St., Lutsk, 43018, Ukraine

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Technological Features of Thermo-mechanical Welding of Sheet Structures

The optimal regime for the formation of strong welded joints by the method of thermo-mechanical welding with the use of intermediate thin foils has been established. The minimum value of the compression force, which allows to approximate the surface of sheet structures without the formation of a shrinkage shell and a welding crater, is determined. The use of an intermediate layer of thin foil, obtained by the electron beam deposition method, allows you to initiate the thermal process of releasing thermal energy, which is sufficient for the formation of a strong welded joint.

Corresponding author:
Yuriy Feshchuk (y.feshchuk@lntu.edu.ua)

Gadzyra Mykola, D.Sc., Senior Researcher
Davydchuk Nadiya, Ph.D., Senior Researcher
Tymoshenko Yaroslav, Ph.D., Senior Researcher
Pinchuk Mykyta, Junior researcher

Frantsevich Institute for Problems of Materials Sciences of the National Academy of Sciences of Ukraine,
3, Akademika Krzhyzhanovsky St., Kyiv, 03142, Ukraine

SECTION: *Technologies for obtaining new materials.*

Synthesis of Nanocomposite Powder Systems Based on Silicon Carbide and MAX-phase Ti3SiC2 and Development of Compositions for the Reception of Electromagnetic Waves

It was established that the process of interaction between SiC–TiH2 powder components is accompanied by the formation of a titanium carbosilicide phase (Ti3SiC2 or MAX-phase) with a nanolaminate structure. Sintering of the synthesized powder leads to the formation of high values of crack resistance and hardness. The resistivity of the created materials based on Ti3SiC2 and their interaction with the electromagnetic field were studied.

Corresponding author:
Gadzyra Mykola (dep14@ipms.kiev.ua)

Golovko Victor [1], D.Sc., Leading Researcher
Krasikov Igor[2], Ph.D.
Iryna Krasikova [2], Ph.D.
Olha Shtofel [1,3], Ph.D.

[1] *E.O.Paton Electric Welding Institute of the National Academy of Sciences of Ukraine,*
11, K. Malevycha St, Kyiv, 03150, Ukraine;

[2] *Frantsevich Institute for Problems of Materials Science of the National Academy of Sciences of Ukraine*,
3 Krzhizhanovsky St., Kyiv, 03142, *Ukraine;*

National Technical University of Ukraine «Igor Sikorsky Kyiv Polytechnic Institute»
37, Prospect Peremohy, 03056, Kyiv-56, Ukraine

SECTION: *Computer modeling and information technology in engineering.*

Study of Properties of the Structure of Materials with Inclusions

The study of the structures of materials with inclusions using the appropriate software is considered. The developed software makes it possible to obtain fractal, structural and statistical characteristics of the material with inclusions based on its two-dimensional image.

Corresponding author:
Krasikov Igor (kiv@ipms.kiev.ua)

Gubenko Svetlana, D.Sc., Professor

Z. I. Nekrasov Institute of Ferrous Metallurgy of the National Academy of Sciences of Ukraine,
1, Akademika Starodubova Sq., Dnipro, 49107, Ukraine;

Dnipro State Academy of Construction and Architecture,
24a, Chernyshevsky St., Dnipro, 49600, Ukraine

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Influence of Laser Action on the Crack Formation Near Inclusions in Steel

The effect of preliminary laser action on the features of crack initiation near non-metallic inclusions at different rates of deformation in a wide range of temperatures was investigated. The mechanism of formation of brittle delaminations at inclusion-matrix boundaries is discussed. The critical parameters of crack initiation near inclusions have been established. The combined effect of temperature and strain rate on the formation of microcracks, as well as the effect of gradient and composite zones in the steel matrix on their development, was studied. The energy range of the pulsed laser exposure is established, which allows obtaining the maximum laser strengthening of the inclusion-matrix interphase boundaries. The role of laser processing in increasing the crack resistance of steels is shown.

Corresponding author:
Gubenko Svetlana e-mail: sigubenko@gmail

Halchuk Tetiana, Ph.D., Associate Professor

Lutsk National Technical University,
75, Lvivska St., Lutsk, 43018, Ukraine

SECTION: *Modern research and prospects for the development of mechanical engineering.*

Technology of Manufacturing Products Using Sludge Waste from Bearing Production

The paper investigates the structure and mechanical properties of composite materials based on SHH15 steel powder obtained by processing grinding sludge waste from bearing production. The influence of technological parameters of the process at the stages of steel powder production, pressing and sintering on the mechanical and tribotechnical properties of sintered materials is considered. The study of the mechanical properties of composites with copper and graphite additives has made it possible to establish the optimal pressing, sintering and charge component composition parameters that provide the best combination of strength properties and tribotechnical characteristics of these materials. The presence of graphite in these materials provides an effective lubricating effect. Adjustable porosity allows for the successful use of liquid lubricant, which fills the pores and, as the metal wears, is forced onto the mating surface. In addition, the friction coefficient in the parts of highly loaded friction units made of sintered materials decreases, and the hardness of the composite increases, which has a positive effect on load capacity.

Corresponding author:
Halchuk Tetiana (t.halchuk@lntu.edu.ua)

Hlotka Olexander, Ph.D, Associated professor
Byelikov Sergiy, D.Sc., Professor
Olshaneckiy Vadum, D.Sc., Professor
Esaylenko Sergiy, Student

National University «Zaporizhzhia Polytechnic»
64, Zhukovsky St., Zaporizhzhia, 69063, Ukraine

SECTION: *Technologies for obtaining new materials.*

Prediction of Carbide Composition in Foundry Nickel-based Superalloy

The work is devoted to the use of X-ray spectroscopy in the study of the specifics of the distribution of alloying elements in the structural components of single-crystal nickel-based superalloys, namely between primary carbides, since the role of carbides in the formation of the properties of these alloys is complex. The activity involves theoretical modeling of thermodynamic processes of the separation of excess phases using the CALPHAD method. As well as a practical study of the structure and distribution of chemical elements in carbides depending on alloy alloying using the REM-106I scanning electron microscope. It was established that in typical carbides, for the system Ni-11.5Cr-5Co-3.6Al-4.5Ti-7W-0.8Mo-0.06C, there is a tendency to regeneration and phase reactions depending on the level of doping with given elements. The obtained dependences were experimentally confirmed using X-ray spectroscopy on nickel-based heat-resistant alloys. It is recommended to use the obtained mathematical models not only when designing new nickel-based superalloys, but also when improving known vintage compositions within the stated concentrations.

Corresponding author:
Hlotka Olexander (Glotka-alexander@ukr.net)

Holenko Kostyantyn [1] , Ph.D.
Yurii Voichyshyn [2], graduate student
Sergiy Posonskiy [1], Ph.D.

[1] *Khmelnytskyi National University*,
11, Instytuts'ka St., Khmelnytskyi, 29016, Ukraine;

[2] *Lviv National Polytechnic University*,
12, Bandery St., Lviv, 79013, Ukraine

SECTION: *Computer modeling and information technology in engineering.*

Peculiarities of the Stress-strain State Analysis of the City Buses Bodies

The boundary conditions formation for the stress-strain state analysis of the city bus body frame under static load conditions is an important stage in the design of new models. In contrast to the indicators of passive safety (determination of deformation zones, etc.), bending stress and torsion of the body frame are present in it during the entire period of operation, therefore, the determination of the structure safety margin and the assessment of its overall uniform strength are an urgent research problem.

Corresponding author:
Kostyantyn Holenko (kgolenko@gmail.com)

Hubal Halyna, Ph.D., Associate Professor

Lutsk National Technical University,
75, Lvivska St., Lutsk, 43018, Ukraine

SECTION: *Computer modeling and information technology in engineering.*

Creation of Macros that Improve Some Actions in LaTeX

This paper deals with the LaTeX programming language which is especially necessary for using math, foreign fonts, complex formatting in large and structural documents. In this paper, it is created macros (source codes are given) in order to improve adding references to everything that can be numbered and to improve adding different types of footnotes in LaTeX documents. These macros can be embodied in a LaTeX style file.

Corresponding author:
Hubal Halyna (halynahbl@gmail.com)

Huliieva Nataliia, Ph.D., Associate Professor

Lutsk National Technical University,
75, Lvivska St., Lutsk, 43018, Ukraine

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Single-layer Filters With Drain Water Flow

The modern state of technological and industrial production is characterized by the search for new materials and technologies for their production and processing. One of the competitive and energy-saving areas is the use of natural minerals as raw materials. Since sorbents based on natural minerals are used to purify drinking water, the effective method is the production of filters based on them in order to reduce the price of filter elements using various modern technologies.

Corresponding author:
Huliieva Nataliia (n.huliieva@lntu.edu.ua)

Husachuk Dmytro, Ph.D., Associate Professor

Lutsk National Technical University,
75, Lvivska St., Lutsk, 43018, Ukraine

SECTION: *Computer modeling and information technology in engineering.*

Reverse Engineering Strategies in Modern Mechanical Engineering Problems

The engineering aspects that can influence the choice of a reverse engineering strategy in the practical tasks of manufacturing prototypes of products are considered, starting from the creation of CAD models and procedures for their technological preparation, to manufacturing by separate methods of additive manufacturing. Based on the analysis of various examples of the implementation of prototyping processes using 3D printing technologies and own research, recommendations have been developed for the selection of strategies for the production of prototypes of mechanical engineering parts in the case of the application of FFF/FDM technologies of additive synthesis. It has been established that the perfection of preprocessing stages in the general prototyping cycle is important for engineering tasks that require the structural accuracy of prototypes.

Corresponding author:
Husachuk Dmytro (d.husachuk@lntu.edu.ua)

Imbirovich Nataliya [1], Ph.D., Associate Professor
Krzystof Jan Kurdzydlowski[2], D.Sc., Professor
Olha Zvirko[3], D.Sc., Professor
Povstyanoy Oleksandr [1], D.Sc., Professor
Inna Boiarska[1], Ph.D., Associate Professor

[1] *Lutsk National Technical University,*
75, Lvivska St., Lutsk, 43018, Ukraine;

[2] *Bialystok University of Technology,*
45c Wiejska St., Bialystok, 15-351, Poland;

[3] *Karpenko Physico-Mechanical of the National Academy of Sciences of Ukraine,*
5, Naukova St., Lviv, 79060, Ukraine

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Ceramic Bio-coatings on Titanium Alloys: Surface Morphology, Chemical Composition

This work has a direct focus on researching the properties of biocoatings synthesized in electrolytes of different composition, the main components of which are liquid glass of potassium hydroxide. Working electrolytes were saturated with phosphates and calcium salts. Diatomite was also added to the workingsolution to saturate the electrolyte with siliceous compounds. It was noticed that the addition of diatomite to the electrolyte leads to the stabilization of the synthesis process, that is, the inclusion of 20 g/l of diatomite in the electrolyte eliminates the moment of a sudden increase in voltage at the anode. It was established that the coatings synthesized in the electrolyte to which hydroxylapatite was added formed with a larger number of craters, but the size of their opening was somewhat smaller.Spectral studies have established that the introduction of hydroxyapatite into the electrolyte increases the content of calcium and phosphorus in the coatings.

Corresponding author:
Nataliia Imbirovych (n.imbirovych@lntu.edu.ua)

Kalinichenko Volodymyr, Ph.D., Associate Professor

Donbass State Engineering Academy,
72, Academichna St., Kramatorsk,
Donetsk region, 84313, Ukraine

SECTION: *Modern research and prospects for the development of mechanical engineering.*

An Integrated Approach to Reducing Energy Consumption in Turning on Heavy Machines

Based on the analysis of studies and publications on the general aspects of the problem of energy efficiency of machining, as well as the specifics of turning processes on heavy machines, the paper presents ways to reduce energy consumption during this processing. Based on the analysis of the energy balance of the machining process, an integrated approach to reducing energy consumption during turning on heavy machines has been substantiated, which provides for measures to reduce energy consumption for physical processes in the cutting zone by reducing the power load in it, reducing energy losses in the mechanical and electrical parts of the main motion drive, as well as energy recovery in machine systems. General approaches to the optimization of turning modes based on the criterion of the minimum specific energy intensity (maximum energy efficiency) of cutting are shown, controllable, as well as some input factors of the model are presented. The use of a self-learning system for automated determination of energy-efficient cutting modes and their correction based on the results of analysis of machining data is proposed. The possibilities of reducing energy losses in the main motion drive and energy recovery in machine systems are considered.

Corresponding author:
Kalinichenko Volodymyr (kww_74-5@i.ua)

Kashytskyi Vitalii, Ph.D., Professor
Savchuk Petro, D.Sc., Professor
Sadova Oksana, Ph.D., Associate Professor
Klymovets Oleksandr, Postgraduate

Lutsk National Technical University,
75, Lvivska St., Lutsk, 43018, Ukraine

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Efficiency of Processing of Components of Polyfilled epoxy Composite Materials in Physical Fields

The improvement of the tribotechnical properties of epoxy composite materials, which contain discrete fibrous fillers and a heat-resistant organosilicon modifier, was determined. The effectiveness of ultrasonic treatment of fibrous fillers in a solvent medium and electromagnetic treatment of organosilicon varnish was established. The use of discrete aramid and glass fibers provides an increase in mechanical characteristics and the coefficient of friction, which positively affects the formation of the structure and properties of friction epoxy composites.

Corresponding author:
Vitalii Kashytskyi (v.kashytskyi@lntu.edu.ua)

Kedrovskyi Sergii, Ph.D.
Koval Yuriy, D.Sc., Professor
Slipchenko Vyacheslav

G.V. Kurdyumov Institute for Metal Physics of the National Academy of Sciences of Ukraine,
36 Academician Vernadsky Boulevard,
UA-03142 Kyiv, Ukraine

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Current Trends for Functional Shape Memory Medical Materials

The current state of the functional materials industry for medical purposes is considered. In addition to the main material Ti-Ni, research of alloys based on biocompatible elements of groups IV and V of the periodic system of chemical elements is actively underway to find the presence of martensitic transformation and their functional properties suitable for practical application. Alloys based on Ti-Nb, Zr-Nb, Zr-Nb-Ta systems seem to be promising for medical use.

Corresponding author:
Kedrovskyi Sergii (sergeyv88001@gmail.com)

Klymenko Sergiy, D.Sc., Professor, Corresponding Member of the NAS of Ukraine
Kopeykina Maryna, Ph.D., Senior Researcher
Melniychuk Yuriy, Ph.D., Senior Researcher

V.M. Bakul Institute of Superhard Materials of the National Academy of Sciences of Ukraine
2, Avtozavodska St., Kyiv, 04074, Ukraine

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Evolution of the Structural State of a Hard Alloy During the Operation of a Cutting Tool

The relationship between the parameters characterizing the structural state of a hard alloy and the wear of a tool equipped with it is considered. The tool with the composite structure characterized by high values of the fractal parameters of homogeneity and orderliness and minimal values of dimensionality has the highest resistance.

Corresponding author:
Klymenko Sergiy (atmu@meta.ua)

Koval Yurii [1], Ph.D., Associate Professor
Fedosov Serhiy [2], D.Sc., Professor
Yashchynskyy Leonid [1], Ph.D., Associate Professor
Zakharchuk Dmytro [1], Ph.D., Associate Professor
Panasiuk Leonid [1], Ph.D., Associate Professor

[1] *Lutsk National Technical University*,
75, Lvivska St., Lutsk, 43018, Ukraine;

[2]*Lesya Ukrainka Volyn National University*,
13, Voli Ave., Lutsk, 43025, Ukraine

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Piezoelectric Properties of Cadmium Antimonide Single Crystals Before and After γ-irradiation

The temperature dependences of the piezoresistance coefficients of cadmium antimonide single crystals doped with tellurium were studied before and after γ-irradiation. It was found that after irradiation, the interval of the change in the sign of the piezoresistance coefficient shifts to the region of higher temperatures, and its absolute value decreases significantly compared to non-irradiated crystals.

Corresponding author:
Koval Yurii (y.koval@lntu.edu.ua)

Kovalov Viktor, D.Sc, Professor
Vasylchenko Yana, D.Sc, Professor
Shapovalov Maxim, Ph.D., Associate Professor
Khoroshailo Vadim, Ph.D., Associate Professor
Stankova Marina, student

Donbas State Engineering Academy,
72, Akademichna St., Kramatorsk, 84313, Ukraine

SECTION: *Design of mechatronic systems.*

System of Adaptive Control of the Machining Process on Heavy Machine Tools

Significant parameters have been identified and mathematical models have been developed to implement an adaptive optimal control system for the machining process on heavy machine tools. Schemes, principles of operation and designs of mechatronic machine units, measuring and diagnostic tools for the implementation of adaptive control have been developed. Adaptive control on a heavy-duty CNC lathe is realized by using programmable logic controllers to set the necessary control laws: cutting speed control to achieve the optimum temperature and feed control to adjust the cutting force. This makes it possible to adjust the developed CNC program during the machining process when external influences on the technological system change. A multilevel decision-making system with artificial intelligence elements was developed and implemented to automatically control cutting processes on adaptive equipment. The results of the work were implemented in the creation of new generation heavy lathes, as well as in the modernization of heavy lathes. Adaptive control systems and software products for selecting operating procedures for heavy machine tools have been developed and implemented.

Corresponding author:
Shapovalov Maxim (wasilchenko.ua@gmail.com)

Kurzydlowski Krzystof Jan[1], D. Sc., Professor
Imbirovich Nataliya [2], Ph.D., Associate Professor
Povstyanoy Oleksandr [2], D.Sc., Professor
Dobosz Romuald [3], Ph.D.

[1]*Bialystok University of Technology,*
45c Wiejska str., Bialystok, 15-351, Poland
[2]*Lutsk National Technical University,*
75, Lvivska str., Lutsk, 43018, Ukraine
[3]*Warsaw University of Technology,*
141 Woloska str., Warszawa, 02-507, Poland

SECTION: *Physical, chemical, technological properties of materials and their structure*

Diatoms Shells as Strengthening Elements of Composite Materials

Over last decades diatoms shells, so called frustules, attracted a lot of attention of materials scientists because of their unique architecture and properties. These shells, built with bio-silica synthesized by diatoms, might have size ranging from a few to hundreds of microns.

The shells have regular overall shape and can be viewed as naturally grown zeolites. When added to polymers and/or metals they reduce specific density of composites. However, for achieving high mechanical properties, it is essential that diatom shells are well bonded to the metal/polymer matrix.

Bonding of bio-silica to polymer/metal matrix in general is relatively weak. However, the unique feature of diatom shells is system of openings forming characteristic regular patterns species specific. These openings, of submicron diameter, provide mechanical interlocking between shells and the matrix which allows for fabrication of high strength composites.

The work presented was focused on empirical and numerical investigations of the interlocking of diatom shells with metal/polymer matrices. PLA, Al, Mg and Ti composites with diatom earth were investigated. Finite Element Modelling was carried out to explain properties of fabricated composites. Results have been used to select most promising types of diatoms for modification of given polymeric or metallic matrix.

Corresponding author
Krzysztof KURZYDLOWSKI (k.kurzydlowski@pb.edu.pl)

Kusyi Yaroslav [1,] Ph.D., Associate Professor
Olha Kostiuk1, Ph.D., Associate Professor
Paola Cocca[2], Professor
Aldo Attanasio2, Professor

[1] *Lviv Polytechnic National University*,
12, Bandera St., Lviv, 79013, Ukraine;

[2] *University of Brescia, Via Branze*
38, Brescia, 25121, Italy

SECTION: *Modern research and prospects for the development of mechanical engineering.*

Development of Economic Criteria to Provide the Functionally-oriented Technologies

The comprehensive recovery of industrial production in Europe and in the world requires the introduction of effective manufacture and repair technologies at mechanical engineering enterprises. The priority task is the technological support of the product's life cycle in accordance with the conditions of its operation in terms of Industry 4.0. Sustainability machining of mechanical engineering parts includes analysing the relationships of economic, social, and environmental dimensions for the technological provision of products quality parameters. The environmental direction has increased its role in the sustainable machining of mechanical engineering parts due to minimizing the consumption of cutting fluids, rational use of different industrial energy in productive processes, recycling chips and cutting tools etc. The development of economic criteria to provide the requirements of sustainable manufacture and machining is no less important than researching their compliance with environmental standards. The technique to solve optimization tasks using the methodology of Markov's chains is suggested to optimization of cutting modes during parts manufacture.

Corresponding author: Yaroslav Kusyi (jarkym@ukr.net)

Kyshchun Volodymyr, Ph.D., Associate Professor

Lutsk National Technical University,
75, Lvivska St., Lutsk, 43018, Ukraine

SECTION: *Strategies and modern technologies in road transport.*

The Electrification of Public Transport is Legalized

A law aimed at stimulating the development of electric transport and its infrastructure in the country is being considered. The new rules will contribute to reducing the amount of harmful emissions into the atmosphere and promote the use of environmentally friendly transport. Certain provisions of the law introduce restrictions on the operation of vehicles with internal combustion engines, with a gradual transition to new standards.

Corresponding author:
Volodymyr Kyshchun (kyshchun52@ukr.net)

Lavrinenko Valerii [1], D.Sc., Professor
Solod Volodymyr [2], Ph.D., Associate Professor

[1] *V.M. Bakul Institute of Superhard Materials of the National Academy of Sciences of Ukraine*
2, Avtozavodska St., Kyiv, 04074, Ukraine;

[2] *Dniprovsk State Technical University,*
2, Dniprobudivska St, Kamianske,
Dnipropetrovsk region, 51918, Ukraine

SECTION: *Modern research and prospects for the development of mechanical engineering.*

Fullness of the Profile of the Rough Surface Obtained by Diamond Abrasive Processing as One of the Factors of Its Holding Capacity

It is shown for the reference curve of a rough surface that the larger the tr indicators are, for example at the level of 20 or 50% of Rmax, the greater the roughness of the surface and the greater its holding capacity.

Corresponding authors:
Lavrinenko Valerii (lavrinen52@gmail.com)
Solod Volodymyr (v_solod@ukr.net)

Liashok Yaroslav, D.Sc., Professor
Podkopaev Sergiy, D.Sc., Professor
Povzun Oleksiy, Ph.D., Associate Professor
Virych Svitlana, Ph.D., Associate Professor
Kalynychenko Valerii, Ph.D., Associate Professor

Donetsk National Technical University
56, Potebni St., Lutsk, 43018, Ukraine

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Composite Material Based on Spent Molding Mixtures of Foundry Production of Machine-building Plants

Waste from foundry shops of machine-building plants – spent molding mixtures – as a siliceous component of foam concrete mixtures was studied. Due to the negative impact on environmental objects, spent molding mixtures of foundry production are waste of the IV hazard class (low-hazard waste). According to the value of the specific activity of natural radionuclides (< 370 Bq/kg), the foundry waste belongs to the I class (that is, spent molding mixtures can be used in construction without restrictions). The spent molding mixtures were studied for their foaming ability. The multiplicity and stability of the foam on different foaming agents were determined. The influence of the components of aerated concrete mixture on the pore-forming ability of foaming agents was studied. Of the six domestically produced foaming agents studied in the work, the most effective was found to be saponified tree resin. The technological parameters for the preparation of aerated concrete mixture have been developed. The average density of foam concrete in the dry state and its limit of compressive strength were used as criteria for resource evaluation of used molding mixtures of foundry production.

Corresponding author:
Povzun Oleksiy (povzun.aleksey@gmail.com)

Maiak Mykola, D.Sc., Professor
Murovanyi Igor, Ph.D., Associate Professor

Lutsk National Technical University,
75, Lvivska str., Lutsk, 43018, Ukraine

SECTION: *Strategies and modern technologies in road transport.*

Modern Transport Technologies in Multimodal Transportation

In the modern world, when we live in the era of high technologies, the transport infrastructure is becoming more and more complex and extensive. This leads to the need for the development of multimodal transportation - systems that combine different types of transport to ensure efficient and fast transportation of goods and passengers. In this context, modern transport technologies play a key role in improving the quality and efficiency of multimodal transport. One of the most important technologies that allows improving multimodal transportation is smart logistics.

Corresponding author:
Maiak Mykola (mayak@lutsk-ntu.com.ua)
Murovanyi Igor (Igor_lntu@ukr.net)

Makarov Volodymyr [1], D.Sc., Professor
Savenok Dmytro [2], Ph.D., Associate Professor
Mastepan Olena[3]

[1] *Vinnytsia National Technical University*,
95, Khmelnytske Shose, Vinnytsia, 21021, Ukraine;

[2] *Donbass National Academy of Construction and Architecture*,
15, Karpatska St., Ivano-Frankivsk, 76019, Ukraine;

[3] *Kharkiv National Automobile and Road University*,
25, Yaroslav Mudryi St., Kharkiv, 61002, Ukraine

SECTION: *Strategies and modern technologies in road transport.*

Development Strategy Formation Improvement of the Production System Car Service Enterprises

A system of evaluation and analysis of individual components of the production system of a car service enterprise has been developed, indicators of its state and level assessment have been determined, and a model has been developed for substantiating directions and the feasibility of expanding the production system.

Corresponding author:
Makarov Volodymyr (makarov@vntu.edu.ua)

Makarova Tamara [1], Ph.D., Associate Professor
Mastepan Serhi [2], Ph.D., Associate Professor
Kuzmin Victor [3]

[1] *Vinnytsia National Technical University*,
95, Khmelnytske Shose, Vinnytsia, 21021, Ukraine;

[2] *Kharkiv National Automobile and Road University*,
25, Yaroslav Mudryi St., Kharkiv, 61002, Ukraine;

[3] *Donbass National Academy of Construction and Architecture*,
15, Karpatska St., Ivano-Frankivsk, 76019, Ukraine

SECTION: *Strategies and modern technologies in road transport.*

Improvement of Production Structures

The system of analysis of the components of the production structure of the automobile transport enterprise is presented, the indicators of its level and state assessment are determined, and a model for justifying the feasibility of expanding the production structure is developed.

Corresponding author:
Makarova Tamara (makarova@vntu.edu.ua)

Maksymiv Olha, Ph.D. , Senior Research Fellow
Kyryliv Volodymyr, Ph.D., Senior Research Fellow
Zvirko Olha, D.Sc., Professor

Karpenko Physico-Mechanical Institute of the National Academy of Sciences of Ukraine,
5, Naukova St., Lviv, 79060, Ukraine

SECTION: *Physical, chemical, technological properties of materials and their structure.*

The Dependence of the Wear Resistance of the Steel with the Surface Nanocrystalline Structure on the Mode of Severe Plastic Deformation

The influence of the mode of deformation during severe plastic deformation by high-speed friction due to mechanical-pulse treatment of 40Х steel by two types of tools: with a straight profile that ensures unidirectional deformation, and with the oppositely directed grooves – for multidirectional deformation was studied. It was established that as a result of such treatment, the surface strengthened layer with nanocrystalline structure and improved physical and mechanical properties is formed on the surface of 40Х steel, namely, increased microhardness, a reduced coefficient of friction and higher wear resistance under dry wear conditions in a pair with cast iron СЧ-20, compared with steel 40Х after quenching and tempering at 200 °C. It was found that as a result of multidirectional severe plastic deformation, the nanocrystalline structure with smaller grain size, greater thickness of the strengthened layer and higher wear resistance is formed compared to unidirectional deformation.

Corresponding author:
Maksymiv Olha (okyryliv@yahoo.com)

Marchuk Viktor, D.Sc., Professor
Tulashvili Yuriy, D.Sc., Professor
Lukianchuk Yurii, Ph.D., Associate Professor
Surynovych Olena, Ph.D., Associate Professor

Lutsk National Technical University,
75, Lvivska St., Lutsk, 43018, Ukraine

SECTION: *Computer modeling and information technology in engineering.*

3D Model Quality Assessment Algorithm for Additive Manufacturing

It describes what mistakes a design engineer often makes when modeling a 3D object and how they affect the quality characteristics of a product manufactured by the FDM method in the additive manufacturing process. But an algorithm for analyzing the part for manufacturability even before the start of its manufacture is proposed.

Corresponding author:
Lukianchuk Iurii (iuriilukianchuk87@gmail.com)

Martyniuk Viktor [1], Ph.D., Associate Professor
Puts Vitaliy [1], Ph.D., Associate Professor
Panchuk Maksym [2], Chief Engineer
Melnyk Yevhenii [1],

[1] *Lutsk National Technical University,*
75, Lvivska St., Lutsk, 43018, Ukraine;

[2] *PJSC «Novovolynsk Foundry»,*
29, Lutska St., Novovolynsk, Volyn region, 45403, Ukraine

SECTION: *Modern research and prospects for the development of mechanical engineering.*

Improving the Efficiency of Processing Castings in a Tumble Blast Machine

One of the important technological operations in the processing of parts after casting is the cleaning of surfaces from residual sand, slag, and other impurities using tumble blast machines. However, existing tumble blast machines have certain drawbacks such as insufficient productivity, low processing quality, high cost, etc.

To improve the efficiency of processing castings and the operation of the tumble blast equipment, it is proposed to install a magnetic separator, an additional tumble blast head with a direct drive, a device for magnetic regulation of the grit supply, an automatic dust collection system with a cartridge (sleeve) filter, a vibrating screen, and an automated process control system for processing.

The improved design of the tumble blast machine will contribute to reducing costs, improving quality, and increasing productivity in foundry production processes.

Corresponding author:
Viktor Martyniuk (martyniukviktor77@gmail.com)

Maruzhenko Oleksii [1], Ph.D.
Mamunya Yevgen [2], D.Sc., Professor
Iurzhenko Maksym [1], D.Sc., Professor

[1] *E.O.Paton Electric Welding Institute of the National Academy of Sciences of Ukraine,*
11, K. Malevycha St., Kyiv, 03150, Ukraine;

[2] *Institute of Macromolecular Chemistry of the National Academy of Sciences of Ukraine*,
48, Kharkivs'ke shose St., Kyiv, 02160, Ukraine

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Application of Segregated Polymer Composites in Plastics Welding

Possible application of pyroresistive composites is resistance welding of plastics using an embedded heating element. The electrothermal processes of segregated composites based on HDPE, that contained different carbon fillers were investigated. The practical use of the developed composites for welding parts made of polyethylene is demonstrated.

Corresponding author:
Maruzhenko Oleksii (a.v.maruzhenko@gmail.com)

Mastepan Mykola, Ph.D., Associate Professor
Vinogradov Mykola, Ph.D., Associate Professor
Kuzmina Victoria

Donbass National Academy of Construction and Architecture,
15, Karpatska St., Ivano-Frankivsk, 76019, Ukraine

SECTION: *Strategies and modern technologies in road transport.*

Improvement of the System of Organization of Service Production at Car Service Enterprises

The control mechanism of the enterprise's production process organization system was developed and presented. It is shown that it is appropriate to use the general level of organization of the production process of car maintenance and repair as a control indicator. A mathematical model for determining the specified indicator has been developed.

Corresponding author:
Mastepan Mykola (mastepanma@gmail.com)

Mazna Oleksandra, Ph.D.
Bezsmertna Viktoriia, Ph.D.
Kokhanyi Valerii
Vasylenkov Yurii

Frantsevich Institute for Problems of Materials Science of the National Academy of Sciences of Ukraine,
3, Krzhizhanovsky St., Kyiv, 03142, *Ukraine*

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Shielding Polymer Composite Materials Based on Combined Fibrous Fillers with a Metamaterial Structure

Combined fibrous fillers containing carbon fibers have been developed, which have a periodic and regular structure, allowing them to be used to create polymer composite materials. Studies of shielding parameters have shown that PCMs based on fibrous fillers with a metamaterial structure can decrease the modulus of the radar signal reflection coefficient to -10÷20 dB, which corresponds to an absorption coefficient of 60-80%.

Corresponding author:
Oleksandra Mazna (mazna@i.ua)

Mikulich Olena, D.Sc., Professor
Samchuk Liudmyla, Ph.D., Associate Professor

Lutsk National Technical University,
75, Lvivska St., Lutsk, 43018, Ukraine

SECTION: *Computer modeling and information technology in engineering.*

The Method of Optimizing the Microstructure of Foam Materials Based on Analytical and Numerical Modeling

The research is aimed at developing methods for modeling the stress-strain state of structural elements made of structurally heterogeneous materials, and evaluating the impact of changes in physical characteristics on their mechanical behavior under various types of external loads. The studies were carried out in the case of foamed polymer materials with closed pores. The development of appropriate methods for calculating stresses and strains in foamed materials was carried out using the apparatus of the micropolar theory of elasticity — the Kosser continuum. The use of this approach made it possible to take into account the influence of shear-rotational deformations. In addition, the use of the Kosser continuum model made it possible to obtain analytical dependences in an integral form for determining stresses and strains in a foam medium under the action of a time-varying load based on the application of the integral Fourier transform in time compatible with the indirect approach of the boundary element method. This method allows not only to compare the results obtained when applying the apparatus of classical and moment theory of elasticity, but also makes it possible to control the calculation error, which is essential in the study of a rapidly changing stress state that occurs under the action of a time-varying load. Also, this approach made it possible to investigate transient processes and study the influence of the microstructure of the material on the change in mechanical behavior under different types of loads.

Corresponding author: Olena Mikulich (shyprao@gmail.com)

Misiura Andrii[1,2], Ph.D.
Mamunya Yevgen[2], D.Sc., Professor
Kulish Mykola[1], D.Sc., Professor
Pylypenko Andrii[2], Ph.D.

[1] *Taras Shevchenko National University of Kyiv*,
4, Prospekt Hlushkova, Kyiv 03022, Ukraine;

[2] *Institute of Macromolecular Chemistry of the National Academy of Sciences of Ukraine*
48, Kharkivske shausse, Kyiv, 02160, Ukraine

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Electrical Conductivity of the LDPE-Cu Composite with Different Types of Filler Distribution

The electrical conductivity of polymer composites based on low-density polyethylene (LDPE) filled with dispersed copper were investigated. Composites were prepared by two different methods to obtain random and segregated types of filler distribution in the polymer matrix. The composite with a segregated structure was studied in an ultra-wide range of copper concentrations from pure LDPE to 100 vol. % of Cu filler. Composites with high Cu concentrations were formed in segregated systems, while for the composite with random filler distribution, a sample with a maximum copper content of 30 vol.% was obtained due to processing restrictions. It is shown that the concentration dependence of the electrical conductivity of both composites exhibits a percolation behavior. Using this theory, the parameters of the percolation equation were determined and the values of the percolation threshold (φ_c) were found. The composite with the random filler structure has a value of φ_c = 23vol.% while the composite with segregated structure has a value of φ_c = 3.3 vol. %.

Corresponding author:
Misiura Andrii (andrii_misiura@ukr.net)

Okhrimenko Viktor, Ph.D Student
Gaponova Oksana, D.Sc., Professor

Sumy State University,
2, Mykola Sumtsova St., Sumy, 40000, Ukraine

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Prospects for the Use of Electrospark Alloying

The work considers the analysis of the main methods that can increase the wear resistance of parts of tribosystems. It was found that traditional methods, such as chemical-thermal treatment and others, have their drawbacks. Instead, methods of surface strengthening and modification, which are based on electrospark alloying (EIL), are promising. EIL has wide possibilities for the formation of a certain structure, phase and chemical composition of the surface, which allows to increase the operational properties of parts. The study of the regularities of the formation of functional coatings by the EIL method, which provide increased wear resistance of steel parts of friction units of machines, is relevant and promising.

Corresponding author:
Okhrimenko Viktor (v.okhrimenko@pmtkm.sumdu.edu.ua)

Olijnyk Nonna, Ph.D., Senior Researcher
Ilnytska Halyna, Ph.D., Senior Researcher
Petasiuk Hryhoriy, D.Sc., Leading Researcher, Senior Researcher
Bazalii Halyna, Ph.D., Senior Researcher

V.M. Bakul Institute of Superhard Materials of the National Academy of Sciences of Ukraine
2, Avtozavodska St., Kyiv, 04074, Ukraine

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Peculiarities of physical and mechanical characteristics of AS20 grade diamond powder with 100/80 grain size and products of its flotation separation

The physico-mechanical characteristics of AC20 diamond grinding powder with a grain size of 100/80 and the products of its flotation separation, which was carried out in one stage, were studied. The work uses well-known methods of researching synthetic diamond grinding powders using the DiaInspect.OSM device. The static strength was investigated using the DA-2 device. It was established that the use of flotation separation of AS20 diamond powder with a grain size of 100/80 allows to obtain diamond powder with an increased strength index under static compression by 23.8%, increased homogeneity in strength by 25.0%, a significantly reduced proportion of impurities and inclusions, and morphometric characteristics close to the original powder.

Corresponding author:
Olijnyk Nonna (oleynik_nonna@ukr.net)

Onysko Oleh, D.Sc., Professor
Matei Iurii
Havryliuk Ivan

Ivano-Frankivsk National Technical University of Oil and Gas,
15, Karpatska St., Ivano-Frankivsk 761019, Ukraine

SECTION: *Modern research and prospects for the development of mechanical engineering.*

Machining of the Tool-Joint Tapered Thread with Increased Wear Resistance

The tapered screw threads are obligatory parts of the drill string and serve to screw its parts together. There are connectors of the small diameters among them that are made in a specific profile of form V-0,05. Thanks to the previous research it was found that the tightness of the drill string can be greatly increased by the use of upgraded tools, which allow to increase the height of the thread profile. In this paper, the authors conducted an analytical study showing the dependence on the contact pressures between the thread surfaces of the two parts of the connector - the box and the pin. Studies have shown that in the screwed state, due to an increase of the height of the thread profile up to 13%, it is possible to reduce the contact pressure between the thread surfaces of the box and the pin for 40-56%, depending on the diameter of the cut. This in turn increases the durability of the tapered thread and its tightness.

Corresponding author:
Onysko Oleh (onysko.oleg@gmail.com)

Orgiyan Alexandr, D.Sc., Professor
Balaniuk Anna, Ph.D., Associate Professor
Tihenko Valentin, D.Sc., Professor

Odessa Polytechnic National University,
1, Shevchenko av., Odesa, 65044, Ukraine

SECTION: *Modern research and prospects for the development of mechanical engineering.*

Amplitude Modulation of Oscillations

When processing by cutting under the conditions of a small reserve of stability amplitude-modeled oscillations usually develop. Reasons modulation of oscillations in the closed dynamic system of the machine often determined by the variability of the rotation speed or eccentricity fastening of the processed workpiece. In this paper based on the analysis experimental results and calculations have clarified the reasons amplitude modulation of oscillations. Modulated oscillations can directly affect the accuracy of processing, and also allow predict the approach to the limit of vibration resistance. It is known that damping the capacity of rotating shafts, in particular spindle assemblies, increases with increasing rotation frequency. A variety of interaction effects of rolling elements and the influence of lubricant complicate the development of consistent calculation methods for determining the damping capacity, but for a number of descriptions of the speed characteristics of damping are proposed models The rotation of individual elements of the elastic system leads to occurrence of amplitude modulation of oscillations and to decrease resonance amplitude values [1]. Stand for APFC registration (amplitude-phase-frequency characteristic) with a spindle that rotating and non-rotating, includes the excitation system and measurement of vibrations: inductive sensors, tensometric and measuring amplifiers, phase voltmeter and electromagnetic vibrator. The damping capacity of the elastic system is determined by APFC.

Corresponding author:
Anna Balaniuk (balanuk.a.v@op.edu.ua)

Petrovska Svitlana [1], Ph.D.; Sergiienko Ruslan [2], Ph.D.;
Ilkiv Bogdan [1], Ph.D.; Takashi Nakamura [3], D.Sc., Professor
Makoto Ohtsuka [3], D.Sc., Professor

[1] *Frantsevich Institute for Problems of Materials Science of the National Academy of Science of Ukraine*
3, Krzhyzhanovsky St., Kyiv 03142, Ukraine;

[2] *Physico-Technological Institute of Metals and Alloys of the National Academy of Science of Ukraine*
34/1, Vernadsky Ave., Kyiv 03142, Ukraine;

[3]*Institute of Multidisciplinary Research for Advanced Materials (IMRAM), Tohoku University*,
Sendai 980-8577, Japan

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Optical, Electrical Properties and Structure of Undoped and M_2O_3 (M=Fe, Al)-doped Multilayer Indium Saving Indium Tin Oxide Thin Films

Multilayer undoped and M_2O_3 (M=Fe, Al)-doped indium-saving indium-tin oxide thin films with low volume resistivity and high transmittance in the visible spectrum have been fabricated by sputtering method. Structures consisting of very thin layer of conventional indium tin oxide (90 mass % In_2O_3 - 10 mass % SnO_2) and undoped or M_2O_3 (M=Fe, Al) indium-saving indium-tin oxide layer with reduced to 50 mass % In_2O_3 content are discussed. By optimizing oxygen flow rate in indium-saving indium-tin oxide layer, the lowest volume resistivity of 281 μΩcm (mobility of 28 $cm^2/V{\cdot}s$, carrier concentration of $5.32{\times}10^{20}$ cm^{-3}) and the highest transmittance in the visible range (98.3 %) were obtained for undoped multilayer thin films sputtered at oxygen flow rate of 0.3 sccm. However multilayer iron- and aluminum-doped indium-saving indium-tin oxide thin films demonstrated the lowest volume resistivity of 378 μΩcm and 445 μΩcm, respectively at lower oxygen flow rate of 0.1 sccm and in pure argon. Doping by oxides increased transmittance of multilayer thin films. Multilayer undoped and M_2O_3 (M=Fe, Al)-doped indium-saving indium-tin oxide thin films are crystallized and show $In_4Sn_3O_{12}$ structure.

Corresponding author: Svitlana Petrovska (sw.piotrowska@gmail.com)

Polinkevich Roman, Ph.D., Associate Professor
Redko Rostyslav, Ph.D., Associate Professor
Chetverzhuk Taras, Ph.D., Associate Professor
Zubovetska Nataliia, Ph.D., Associate Professor

Lutsk National Technical University,
75, Lvivska St., Lutsk, 43018, Ukraine

SECTION: *Modern research and prospects for the development of mechanical engineering.*

The Impact of the Supporting System of the Machine on its Quality Indicators

Interest in the hardness of machine tool units is constantly growing due to the development of industry in the field of creating new designs of metal cutting machines, cutting tools, new brands of processed materials and technological processes. The inconsistency of these elements creates a danger of vibrations not only when cutting, but also when idling. The improvement of the cutting tool increases the volume of chips removed from the workpiece per unit of time with a significant increase in the speed of the machines. Increasing the speed requires improving the inertial properties of the machine tools and increasing their reliability, which is achieved by reducing the size of spindle assemblies, lead screws, and lightening the calipers and tables. Reducing the mass of nodes that move and rotate can serve as a reason for reducing rigidity and vibration resistance.

Corresponding author:
Chetverzhuk Taras (t.chetverzhuk@lutsk-ntu.com.ua)

Posuvailo Volodymyr [1], Ph.D., Senior Researcher
Bilyi Levko[1], Ph.D., Senior Researcher
Ivashkiv Vasyl[1], Ph.D., Researcher
Kovalchuck Ihor[1], Ph.D., Researcher

[1]*Karpenko Physico-Mechanical of the National Academy of Sciences of Ukraine,*
5, Naukova St., Lviv, 79060, Ukraine

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Corrosion Properties of Oxide Ceramic Coatings Synthesized on D16 and Amg5 Alloys

Plasma electrolytic oxidation (PEO) is an effective, relatively new type of surface treatment and strengthening of metal products. It is often used to form oxide ceramic coatings. However, the possibilities of the method have not been studied enough. The optimal current density for the synthesis of such coatings is 20...25 A/dm^2 at a fairly low rate of formation (2 μm/min). To reduce energy consumption, methods of increasing the oxygen content in the electrolyte are used. One of them is checking the electrolyte with ozone. In this work, the influence of ozone on the corrosion properties of coatings synthesized on D16 and AMg5 alloys in a 3% aqueous solution of NaCl and in the same solution saturated with hydrogen sulfide was evaluated. It was established that the corrosion resistance of the coated alloys is two orders of magnitude higher than that of the original alloys. Corrosion processes occur in the through pores of coatings. The results of impedance studies showed that their resistance increases after 20 days of being in a corrosive environment and remains significant for 150 days.

Corresponding author:
Volodymyr Posuvailo (vposuvailo@gmail.com)

Povstyanoy Oleksandr [1], D.Sc., Professor
Imbirovich Nataliya [1], Ph.D., Associate Professor
Rusakov Denis [2]

[1]*Lutsk National Technical University,*
75, Lvivska St., Lutsk, 43018, Ukraine;

[2]*Kovel Industrial and Economic Professional College*,
23, Zavodska str., Kovel, 45000, Ukraine

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Research of the Properties of Highly Efficient Titanium Porous Materials from Waste of Biomedical Production

Titanium is characterized by an interesting combination of such properties as high strength, low density, corrosion resistance and biocompatibility. Although the widespread use of titanium at the industrial level has not yet been achieved due to the high costs of its extraction and production. Therefore, titanium is increasingly used in sectors with high demands, such as the aerospace industry or the production of biomedical devices, where the final high cost is not a major factor.

It is believed that the processing of titanium and its alloys using powder metallurgy methods is a significant way to reduce the cost of manufacturing titanium products, and also provides the opportunity to develop new alloys that are difficult to obtain using traditional technologies.

This work is devoted to the processing of titanium powder from biomedical production waste using various PM methods and is aimed at researching the processing of almost pure, chemically homogeneous and fine-grained titanium-based components.

Corresponding author:
Povstyanoy Oleksandr (povstjanoj@ukr.net)

Povstyanoy Oleksandr [1], D.Sc., Professor
Mikhailov Anatoliy [2], Junior Researcher
Stefan Yevhenii [3], D.Sc., Professor
Mikhailov Oleg [2], D.Sc., Leading Researcher, Senior Researcher

[1] *Lutsk National Technical University*,
75, Lvivska St., Lutsk, 43018, Ukraine;

[2] *Frantsevich Institute for Problems of Materials Sciences of the National Academy of Sciences of Ukraine,*
3, Akademika Krzhyzhanovsky St., Kyiv, 03142, Ukraine;

[3] *National Technical University of Ukraine «Igor Sikorsky Kyiv Polytechnic Institute»*
37, Prospect Peremohy, 03056, Kyiv-56, Ukraine

SECTION: *Computer modeling and information technology in engineering.*

Determination of a Rational Scheme of Pressing in the Manufacture of Multilayer Filter Elements

The process of radial isostatic pressing of multilayer filter elements was researched by computer modeling. Two schemes for obtaining cylindrical filter elements was considered (pressing on a mandrel and pressing on a matrix). The scheme of pressing on a mandrel is advisable to use in the manufacture of multilayer filter elements.

Corresponding author:
Mikhailov Oleg (olmi2016@i.ua)

Privalko Eleonora, Ph.D., Senior Researcher

Bogomolets National Medical University,
13, blvd. Tarasa Shevchenko, Kyiv, 01601, Ukraine

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Structure and Thermodynamic Properties of Polymer Systems with Intramolecular Chemical Hemogenity

The work experimentally investigated the hierarchy of structural nanoheterogeneities in polymer systems with intra- and intermolecular chemical heterogeneity in order to find out their influence on the thermodynamic properties of such systems. The presence of clear reflexes on the curves of small-angle X-ray scattering (SAXS) for samples of segregated polyurethanes is a characteristic sign of the existence of a macrolattice of nanodomains that arose as a result of self-association of rigid chain segments in the continuous phase of flexible segments. It was established that the periodicity of the macrolattice for the samples decreases linearly with the mass content of rigid segments. Elongation of rigid segments and/or blocking of chain ends has been found to result in a higher depth of phase separation. The relatively low depth of phase separation is the reason for the emergence of a hierarchy of morphological structures, starting from nanophases with a predominant content of flexible segments or rigid segments and ending with an interphase layer of variable composition. A significant proportion of the interfacial layer consists of sterically immobilized flexible segments on the periphery of nanodomains of rigid segments. An increase in the relative content of the interphase layer with a decrease in the depth of the phase interface is manifested in a decrease in the intensity and expansion of the relaxation time spectrum of the processes of non-cooperative and cooperative mobility of flexible segments.

Corresponding author:
Privalko Eleonora (elprival@ukr.net)

Prydalnyi Borys, Ph.D., Associate Professor

Lutsk National Technical University,
75, Lvivska St., Lutsk, 43018, Ukraine

SECTION: *Modern research and prospects for the development of mechanical engineering.*

Synthesis of Structures for Automatic Clamping Mechanisms with Extended Technological Capabilities

Automatic clamping mechanisms used in metalworking machines to hold workpieces and tools in machine spindles determine the possibility of using the potential of the machine to increase the cutting modes. The research is aimed at the development of new approaches to the creation of automatic clamping mechanisms with the ability to provide qualitatively new and necessary characteristics of their functioning. The creation of new features is achieved by introducing appropriate changes at the level of the object structure. The obtained results provide better opportunities for the development of the structures of automatic clamping mechanisms by improving the systematisation of the verification of an increased number of alternative options for their structural elements. This is achieved by solving the problem of formal description and the possibility of representing structural elements functioning on the basis of various physical effects within one subject area of the systematisation matrix. The results obtained also provide an increase in the heuristic potential in design.

Corresponding author:
Prydalnyi Borys (b.prydalnyi@lutsk-ntu.com.ua)

Prysyazhnyuk Pavlo, Ph.D., Associate Professor
Molchanov Andrii

Ivano-Frankivsk National Technical University of Oil and Gas,
15, Karpatska St., Ivano-Frankivsk, 76019, Ukraine

SECTION: *Computer modeling and information technology in engineering.*

Determination of the Mechanical Properties of the Borides $Fe_{1-x}Cr_xMo,B)_2$ Solid Solutions by Virtual Crystal Approximation Technique

Using the virtual crystal approximation approach as implemented in the CASTEP ab initio code, the elastic constants and the associated mechanical properties (Young's modulus, Vickers hardness etc.) were determined for the solid solutions based on the tetragonal $Fe_{1-x}Cr_x(Mo,B)_2$ boride phase. It was found that the concentration dependencies of the elastic moduli B and G can be fitted by curves with local minima corresponding to the equiatomic concentrations of Cr and Fe in the boride phase. The highest predicted value of the Vickers hardness (HV = 34 GPa) corresponds to solid solution $Fe_{0.8}Cr_{0.2}(Mo,B)_2$, which is also the ductile phase according to the B/G criterion. The solid solutions of such a composition can be used during the design of new alloy systems for the harfacing alloys deposited by arc welding and for working conditions where intense abrasion is present.

Corresponding author:
Prysyazhnyuk Pavlo (pavlo1752010@gmail.com)

Puts Vitaliy, Ph.D., Associate Professor
Muravynets Yuliia, Ph.D., Associate Professor
Klymenko Oleksandr, Ph.D., Associate Professor

Lutsk National Technical University,
75, Lvivska str., Lutsk, 43018, Ukraine

SECTION: *Modern research and prospects for the development of mechanical engineering.*

Increasing the Reliability of Gear Wheels

The basic operations of finish treatment of gear-wheels are considered, directions of perfection of methods of forming of superficial layer of material are set with necessary properties. The urgent task of machine and instrument engineering is to ensure the strength, reliability and durability of both mechanism elements as a whole and their component parts with minimal material content and manufacturing costs. In the vast majority of units and machines, ensuring the accuracy of the transmission of kinematic movements and torques is entrusted to a variety of gears, the main link of which is a gear wheel. The destruction of machine parts begins with their surface layers, the properties of which are formed by the processing technology, which is a set of operations that are interconnected and interdependent. It is at this stage, and mainly at the stage of finishing, that the reliability of gears is formed.

Undoubtedly, the operating conditions have a significant impact on the quality of the working surfaces of the parts, as a rule, worsening them, however, the basis of the indicators of the quality of the material condition of the surfaces is laid by the manufacturing technology.

Corresponding author:
Vitaliy Puts (vitaliy.puts@lntu.edu.ua)

Ragulskis K. [1]
Pauliukas A. [2]
Paškevičius P. [3]
Maskeliūnas R. [4]
Ragulskis L. [5]

[1] *Kaunas University of Technology,* Kaunas, Lithuania;
[2] *Vytautas Magnus University, Akademija,* Kaunas District, Lithuania;
[3] *Company «Vaivora»*, Kaunas, Lithuania;
[4] *Vilnius Gediminas Technical University*, Vilnius, Lithuania;
[5] *Vytautas Magnus University*, Kaunas, Lithuania

SECTION: *Design of mechatronic systems.*

Pipe Robot with Self-stopping Mechanism

Pipe robots are used in agricultural engineering for transportation of various materials inside the pipe as well as for cleaning of internal surfaces of the pipes. Model of a pipe robot with self-stopping mechanism is proposed and described in detail. Numerical investigations are performed, and the obtained results are presented in the form of graphical relationships. Variations of displacements as well as variations of velocities of the exciting mass and of the case of the pipe robot as functions of time are investigated. Results for steady state regime of motion are obtained. Results for three typical values of the constant force are obtained: first the results when the constant force is assumed equal to zero and then the results for the two typical nonzero values of the constant force are obtained. From the obtained graphical representations, the influence of the value of the constant force to the dynamic behavior of the pipe robot can be seen. The obtained graphical representations enable to understand the behavior of the investigated pipe robot with self-stopping mechanism.

Corresponding author:
Pagarbiai Arvydas (arvydas.pauliukas@vdu.lt)

Ragulskis K. [1]
Pauliukas A. [2]
Paškevičius P. [3]
Maskeliūnas R. [4]
Ragulskis L. [5]

[1] *Kaunas University of Technology,* Kaunas, Lithuania;
[2] *Vytautas Magnus University, Akademija,* Kaunas District, Lithuania;
[3] *Company «Vaivora»*, Kaunas, Lithuania;
[4] *Vilnius Gediminas Technical University*, Vilnius, Lithuania;
[5] *Vytautas Magnus University*, Kaunas, Lithuania

SECTION: *Design of mechatronic systems.*

Two-Sided Soft Impacts

In various engineering devices used in robotics, transport and agricultural engineering two-sided impacts take place. Model of the investigated vibrating system with two-sided soft impacts is described in detail. Dynamics of the investigated system with two-sided soft impacts takes place according to the three typical regimes of motion: vibrating system is not connected with the supports, vibrating system is connected with the first support, vibrating system is connected with the second support. Investigation of steady state regimes of motion for various stiffnesses of the supports is performed. The obtained graphical representations enable to understand the behavior of the investigated vibrating system with two-sided soft impacts in steady state regimes of motion for various stiffnesses of the supports. The obtained results of the performed investigation are applied in the process of design of pipe robots and other engineering devices.

Corresponding author:
Pagarbiai Arvydas (arvydas.pauliukas@vdu.lt)

Ratska Nadiia, Ph.D.
Ivashkiv Vasyl, Ph.D., Researcher
Chuchman Marian, Ph.D., Researcher
Vasyliv Chrystyna, Senior Researcher

Karpenko Physico-Mechanical Institute of the National Academy of Sciences of Ukraine,
5, Naukova St., Lviv, 79060, Ukraine

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Effectiveness of Low Carbon Steel Hydrogenation in Corrosive Environments in the Presence of H_2S and CO_2

The influence of the hydrogen sulfide and carbon dioxide concentration in a chloride acetate solution on the hydrogenation of a membrane made of steel 20 was studied. It was shown, that the concentration of hydrogen in the surface layers of the membrane increases by ∼2.5 times with an increase in the hydrogen sulfide content from 100 to 1000 mg/l. The apparent hydrogen diffusivity does not depend on the concentration of hydrogen sulfide in the solution and is ∼2.09·10-8 cm2/c.

Corresponding author:
Ratska Nadiia (nadija.ratska@gmail.com)

Redko Nazarii, Postgraduate
Redko Rostyslav, Ph.D., Associate Professor

Lutsk National Technical University,
75, Lvivska St., Lutsk, 43018, Ukraine

SECTION: *Modern research and prospects for the development of mechanical engineering.*

The Problem of Developing Low-waste Technologies for the Production of Clamping Collets for High-performance Processing Machines

With the modern requirements of saving materials and saving resources, the problem of developing low-waste technologies for the production of clamping collets, which would allow the production of collets with minimal costs, is acute. The stabilization of the characteristics of the clamping collets contributes to the maximum use of the reserves of the clamping mechanism from the point of view of increasing the productivity and accuracy of processing, saving energy and materials.

Corresponding author:
Redko Rostyslav (redkorg@ukr.net)

Reshetylo Anatolii, Postgraduate
Sychuk Viktor, Ph.D., associate professor

Lutsk National Technical University,
75, Lvivska St., Lutsk, 43018, Ukraine

SECTION: *Modern research and prospects for the development of mechanical engineering.*

Improvement of Plasma Cutting Modes by Analysis of Combustion Products

To reduce risks of low-quality and inefficient plasma cutting work, it is suggested to constantly monitor the most optimal modes of operation of plasma equipment by constantly analyzing the combustion products that occur during cutting, and therefore influence the work of the executive elements of plasma cutting equipment.

Corresponding authors:
Sychuk Viktor (svamator@gmail.com)
Reshetylo Anatolii (anatolii.reshetylo16@gmail.com)

Samostian Viktor, Ph.D., Associate Professor

Lutsk National Technical University,
75, Lvivska St., Lutsk, 43018, Ukraine

SECTION: *Computer modeling and information technology in engineering.*

The Use of Universal Forms and Simple Geometric Images in Car Design

The work presents the results of the analysis of the stages of formation and the history of the development of car design. The concept of universality of form and its application in car design is defined. As a result of the conducted research, some general steps that should be taken into account when designing a car are outlined. The advantages of using universal shapes and simple geometric elements in car design are outlined. This made it possible to generalize the principle of universality of form and the use of simple geometric images in the creation of car design, which is effective, practical and aesthetically attractive.

Corresponding author:
Viktor Samostian (svrmbf@gmail.com）

Sapon Serhii [1], Ph.D., Associate Professor
Klochko Oleksandr [2], D.Sc., Professor
Sergiy Ponomarenko [1], Ph.D., Associate Professor
Dmytro Dzyuba [1]

[1] *Chernihiv Polytechnic National University*,
95, Shevchenko St., 14035, Chernihiv, Ukraine;

[2] *National Technical University «Kharkiv Polytechnic Institute»*,
2, Kyrpychova St., 61002, Kharkiv, Ukraine

SECTION: *Computer modeling and information technology in engineering.*

The Digital Twin Model of the Spindle Unit

The spindle system of any machine tool directly and significantly influence on the efficiency of machining. The dynamic characteristics of the spindle unit during machining are almost impossible to visualize in real time with traditional methods. The use of a digital twin of the spindle unit allows to determine the actual dynamic characteristics with a sufficiently high degree of accuracy. The key component of the digital twin of the spindle unit is its model. It is a set of digital models that describe its design, technological, operational, parameters and physical and mechanical processes that occur during the operation of the spindle unit in real time. The structure, list of characteristics of the digital twin model of the intelligent spindle unit are determined. The stages of its model creation are given, the tasks to be solved at these stages are specified. Building a model of a digital twin of a spindle unit has a two-directional character and cannot be considered a fully completed process, since the model of a digital twin of a spindle unit will be constantly refined and updated until the spindle unit is out of service. High-precision modeling, model integration, model verification, model consistency, mechanisms of functioning and evolution of models - are key issues, that need to be solved when creating a model of a digital twin of a spindle unit.

Corresponding author: Serhii Sapon (s.sapon@gmail.com)

Shapoval Mykola, Ph.D., Associate Professor
Viktor Virchenko, Ph.D., Associate Professor
Kryvorot Anatilii, Ph.D., Associate Professor
Mykhailik V., Postgraduate

National University «Yuri Kondratyuk Poltava Polytechnic»
24, Pershotravnevy Avenue, Poltava, 36011, Ukraine

SECTION: *Modern research and prospects for the development of mechanical engineering.*

Hydraulic Single Piston Mortar Pump with Combined Increased Volume Compensator

The analysis of existing mortar pump designs is carried out, the main disadvantages and advantages of their performance indicators are indicated. The main directions of new mortar pumps designs development are determined. A new design of a hydraulic driven single-piston mortar pump with a combined compensator of increased volume is proposed. The design features of the mortar pump and the principle of its operation are given. The design features of the enlarged volume compensator, suction chamber and cooling chamber of the cylinder-piston group are disclosed. The design features of valve components are indicated and their rational parameters are indicated, which will ensure minimal reverse leakage of solutions of different mobility when using a hydraulic drive, which will ensure a constant speed of the working body. According to the research results, it was established that a single-piston hydraulic mortar pump with a combined compensator of increased volume proved to be more effective.

Corresponding author:
Shapoval Mykola (nvshapoval75@ukr.net)

Shymchuk Serhii, Ph.D., Associate Professor
Pivnytsky Mykola
Zaichuk Nataliya, Ph.D., Associate Professor
Martyniuk Viktor, Ph.D., Associate Professor

Lutsk National Technical University,
75, Lvivska St., Lutsk, 43018, Ukraine

SECTION: *Modern research and prospects for the development of mechanical engineering.*

Prospects For The Use Of Conveyor-Type Mobile Belt Machines

Various types of conveyors and conveyors are most widely used for transportation, loading and unloading of goods, finished products or materials at different distances (heights). Such machines may have certain design features that depend on the conditions of their operation or the products being transported. Usually, the most used are tape-type installations.

Conveyor-type machines are very common for various types of tasks in the mechanical engineering industry. In particular, they are used in light industry (shoe production, hardware production), for transportation of agricultural products, forestry complex, coal and bearing industries.

A layout with split conveyors, where the loading section has its own conveyor, and the intermediate section has its own, will help reduce the loss of transported material at the point of transfer from the horizontal part to the slope, and will reduce the load on the conveyor belt in the intermediate section. Separation of such a machine into two conveyors will provide better start-up opportunities at a loaded start.

Corresponding author:
Shymchuk Serhii (s.shimchuk@lntu.edu.ua)

Sukhova Olena[1], D.Sc., Professor
Polonskyy Volodymyr [2], Ph.D., Associate Professor

[1] *Institute of transport systems and technologies of the National Academy of Sciences of Ukraine*
5, Pisarzhevsky St., UA 49005 Dnipro, Ukraine;

[2] *Oles Honchar Dnipro National University*,
72, Gagarina Ave., Dnipro, 49010, Ukraine

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Corrosion of Icosahedral and Decagonal Quasicrystals of Al–Cu–Fe and Al–Cu–Co Alloys

The corrosion of Al–Cu–Fe and Al–Cu–Co alloys that form quasicrystalline phases, respectively three-dimensional icosahedral ψ-phase and two-dimensional decagonal D-phase, was investigated in this work. The phases containing less iron in the structure of the Al–Cu–Fe alloys or phases containing more cobalt in the structure of the Al–Cu–Co alloys are less susceptible to corrosion.

Corresponding author:
Sukhova Olena (sukhovaya@ukr.net)

Sychuk Viktor [1], Ph.D., Associate Professor
Sychuk Alina [2]

[1] *Lutsk National Technical University,*
75, Lvivska St., Lutsk, 43018, Ukraine

[2] *Lutsk Lyceum No. 14*
named after Vasyl Sukhomlynskyi of
Lutsk City Council

SECTION: *Design of mechatronic systems.*

Remote-controlled Robotic Manipulator

The essence of the work is to create a manipulator robot that repeats the movements of the limbs of a human operator in real time for remote performance of work in dangerous conditions or hard-to-reach places.The developed robot "Avatar" consists of five systems: 1 - electricla power sources; 2 - a control "glove" of the operator; 4 - manipulator; 5 - remote vision.

Corresponding author:
Sychuk Alina (alindron666@gmail.com)

Sydorchuk Oleh[1, 2], Ph.D., Renior Researcher
Gogaev Kazbek[1], D.Sc., Professor
Radchenko Oleksandr[1], D.Sc.
Askerov Mukafat, Ph.D., Senior Researcher
Podrezov Yuriy[1], D.Sc., Professor
Yevich Yan[1], Ph.D., Senior Researcher

[1] *Frantsevich Institute for Problems of Materials Science of the National Academy of Sciences of Ukraine*,
3, Krzhizhanovsky St., Kyiv, 03142, Ukraine;

[2] *Ningbo IPMS research and technology center Co.,*
Ltd. No 218, Ningbo city, China

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Release Brittleness of Die Steel 4Kh4N5M4F2 (Without High-Temperature Machining)

Steel with adjustable austenitic transformation during operation (4Kh4N5M4F2) was studied. The presence of temper brittleness at a temperature of 450-500 °C, associated with the maximum value of the parameter "a" of the crystal lattice during the formation of a solid substitution solution in the "Fe-C" system and the release of the carbide component, was established. The minimum value of the impact toughness of steel is 15 J/cm^2 after tempering at a temperature of 475 °C. It has been confirmed that the formation of a solid solution of the $Fe_{1-x}Ni_x$ type occurs in the temperature range of tempering brittleness (450-500°C), as a result of which the parameter "a" of the crystal lattice increases, which causes a decrease in the impact viscosity and increasing brittleness.

Corresponding author:
Sydorchuk Oleh (sedoroleg@ukr.net)

Symonyuk Volodymyr, Ph.D., Associate Professor
Tymoshchuk Anton, graduate student

Lutsk National Technical University,
75, Lvivska St., Lutsk, 43018, Ukraine

SECTION: *Modern research and prospects for the development of mechanical engineering.*

To the possibility of improving 3D printing using SLS technology

Research is aimed at improving 3D printing using SLS technology, which can be achieved by strengthening the laser system of the device, that is, increasing the speed of the device. The speed of printing using the technology of selective laser sintering means how quickly the laser beam can heat microparticles of powder to their sintering temperature without damaging the quality of the printing material. The perspective is the need to conduct scrupulous studies of the effect of the power of the laser beam on the speed of bringing the powder fragment of the corresponding area to a temperature at which high-quality sintering of the material fragment with others is possible, and at the same time will not lead to the destruction of the material due to overheating, its burning, or deterioration of physical and mechanical properties properties. Also, it is necessary to take into account the distance to the laser and the number of sintered layers under the newly created layer.

Corresponding author:
Simonyuk Volodymyr (v.symonyuk@lntu.edu.ua,
volodimir_simonyuk@ukr.net)

Synytsia Anna[1]
Sych Olena, Ph.D. [1,2], Senior Researcher
Yevich Yan[1], Ph.D.
Vedel Dmytro[1], Ph.D.
Babutina Tetiana[1]
Kondratenko Iryna[1]

[1] *Frantsevich Institute for Problems of Materials Science of the National Academy of Sciences of Ukraine*,
3, Krzhyzhanovsky St., Kyiv 03142, Ukraine;

[2] *Institute of High Pressure Physics "Unipress", PAS*,
ul. Sokołowska 29/37, 01-142 Warsaw, Poland

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Mechanical Properties of Hydroxyapatite-based Biocomposites Modified by Magnetite and Chitosan

The work is devoted to the study of the mechanical properties of biogenic hydroxyapatite-based composites modified by magnetite (1, 5, 25 and 50 wt.%) and chitosan. It was established that increase in content of magnetite in composite composition from 1 to 50 wt. % lead to decrease in porosity from 38 to 29 % and significantly increase (7 times for compressive strength and Young's modulus) in mechanical properties, correspondingly, in comparison with pure biogenic hydroxyapatite. Moreover, prepared composites have mechanical properties with that of human cancellous bone, which in combination with their structure, magnetic and resorption properties as well as non-toxicity make them promising for replacement of bone tissue defects that do not under mechanical loads.

Corresponding author:
Anna Synytsia（synytsia.ann@gmail.com）

Tkachuk Valentyna[1], D.Sc, Professor
Petro Topilnytskyy[2], Ph.D., Professor

[1]*Lutsk National Technical University*,
75, Lvivska St., Lutsk 43018, Ukraine;

[2] *Lviv Polytechnic National University*,
12, Stepana Bandera St., Lviv, 79000, Ukraine

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Analysis of the Prospects for Biodiesel Fuel Production

The worldwide increasing demand for energy prompts scientists to focusing their research fields at developing sustainable processes for using renewable source of energy. The geo-political crises and the high concern for global warming, caused by greenhouse gas emissions from the combustion of fossil fuels made the depletion of fossil reservoirs become really dramatic for European Countries.

The use of waste biomass as energy feedstock is very interesting for economics and environment. Although the EU banned the production of petrol and diesel automotives by 2035, the employing of biodiesel from waste biomass seems a very interesting alternative, solving problems connected to both fossil depletion and waste disposal.

Corresponding author:
Tkachuk Valentyna (v.tkachuk@lntu.edu.ua)

Trush Vasyl [1], Ph.D. Senior Research Fellow
Pohrelyuk Iryna [1], D.Sc, Professor
Luk'yanenko Alexander [1], Ph.D.
Kravchyshyn Taras [1], Ph.D.
Tykhonovs'кyi Mychail [2], Ph.D. Senior Research Fellow
Stoev Petro [2], D.Sc, Professor

[1] *Karpenko Physico-Mechanical Institute of the National Academy of Sciences of Ukraine*
5, Naukova St., Lviv, 79060, Ukraine,

[2] *Institute of Solid State Physics, Materials Science and Technologies of the National Scientific Center «Kharkiv Institute of Physics and Technology» of the National Academy of Sciences of Ukraine,*
1, Akademichna St., Kharkiv, 61108, Ukraine

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Influence of Modification of the Surface Layer with Oxygen on the Oxidation Resistance of the Zr-1%Nb Alloy

The work is aimed at improving the properties of fuel rod tubes made of Zr-1%Nb alloy by modifying the near-surface metal layer with interstitial elements. Chemical-thermal treatment (CHT) was used as a modification method, which consisted in diffusion saturation of the near-surface metal layer with oxygen. The effect of CHT regimes on the oxidation of samples of the Zr-1%Nb alloy in air is considered. It is shown that CHT leads to a decrease in weight gain during oxidation for 100 hours in air at a temperature of 550°C. A conclusion is made about the prospects of using CHT to increase the resistance to oxidation of Zr-1%Nb alloy tubes.

Corresponding author:
Vasyl Trush (trushvasy@gmail.com)

Togobitskaya Daria, D.Sc., Professor
Molchanov Lavr, Ph.D.
Kislyakov Volodymyr, Ph.D.
Likhachev Yuriy, Ph.D.

Z.I Nekrasov Iron and Steel Institute of the National Academy of Sciences of Ukraine,
1, Akademika Starodubova square, Dnipro, 49107, Ukraine

SECTION: *Computer modeling and information technology in engineering.*

Development of Information and Mathematical Support for an expert System for Out-of-furnace Desulphurisation of Cast Iron

Modular mathematical models have been developed to optimise the end-to-end process and its information and mathematical support. An integrated database has been created that summarises information on the parameters of the technology of desulphurisation of cast iron with granular magnesium. The expert system "Out-of-furnace treatment of cast iron" is described and presented, which allows to ensure the production of high-quality metal products.

Corresponding author:
Togobitskaya Daria (dntog@ukr.net)

Tsybulenko Vsevolod
Vorontsov Borys, Ph.D., Associate Professor

National Technical University of Ukraine
«Igor Sikorsky Kyiv Polytechnic Institute»
37, Prospect Peremohy, 03056, Kyiv-56, Ukraine

SECTION: *Modern research and prospects for the development of mechanical engineering.*

Methods of Assessment of Substative-additive Production

The need for "subtractive manufacturing" and "additive manufacturing" is a necessity at the same time, and this kind of interlaced processing seems to have become a trend. However, how do you continuously improve processing in a smart way? Qualified performance improvement should be objectively assessed, and continuous review and improvement should be based on identifiable and quantified performance measures.

Corresponding author:
Tsybulenko Vsevolod (momosc2tv@gmail.com)

Valetskyi Bohdan, Ph.D., Associate Professor

Lutsk National Technical University,
75, Lvivska St., Lutsk, 43018, Ukraine

SECTION: *Computer modeling and information technology in engineering.*

Automated Warehouse

An automated warehouse is a logistics center that uses computer systems and robotic devices for storage, movement, and processing of goods, ensuring fast order processing, inventory accuracy, reduced labor costs, and increased productivity. Modern logistics centers use automatic sorting systems, robotic devices, scanning and identification systems for goods, as well as software for warehouse management and customer interaction, ensuring constant availability of all storage units.

Corresponding author:
Valetskyi Bohdan (b.valetsky@lntu.edu.ua)

Alina Vashchuk [1,2], Petr Stanovský [1], Sergiy Rogalsky [3],
Oksana Tarasyuk [3], Nicolas Delpouve [2], Eric Dargent [2]
Pavl Izak [1], Mariia Pasichnyk [1]

[1] *The Czech Academy of Sciences*,
Institute of Chemical Process Fundamentals,
Rozvojova 135, 165 02 Prague 6 – Suchdol, Czech Republic;

[2] *Univ Rouen Normandie, INSA Rouen Normandie, CNRS,*
Groupe de Physique des Matériaux UMR 6634, F-76000
Rouen, France;

[3] V.*P. Kukhar Institute of Bioorganic Chemistry and Petrochemistry*,
National Academy of Sciences of Ukraine,
50, Kharkivske schose, Kyiv, 02160, Ukraine

SECTION: *Technologies for obtaining new materials.*

Fabrication of New Ionic Liquid/Polyetherimide Composite Membranes for Gas Separation

In this study, novel composite membranes were obtained by incorporating hydrophobic protic ionic liquid, 2-butylaminoimidazolinium bis(trifluoromethylsulfonyl)imide ([BAIm][TFSI]) into commercial poly(ether imide sulfone) (XH-1015, EXTEM™ RESIN) at concentrations of 20-60 wt%. The films were prepared by casting from methylene chloride solutions, and their structure and properties were investigated using EDS, FTIR, DSC, TGA, and sessile-drop water contact angle measurements. FTIR analysis revealed a physicochemical interaction between the carbonyl group of the imide cycle and imidazolinium cations via hydrogen bonding in the PEI/[BAIm][TFSI] composite films. Moreover, the introduction of the ionic liquid led to an increase in the hydrophilicity of the composite membrane surface, as evidenced by a decrease in the contact angle. According to DSC data, a significant shift of the glass transition temperature toward lower values was observed in PEI/[BAIm][TFSI] compared to the individual PEI. Despite the plasticizing effect, all composites exhibited excellent thermal stability up to 400 °C. The composite membranes were tested for their gas separation performance, specifically their potential to selectively separate CO2 and CH4 gas streams. The CO2/N2 and CO2/CH4, CH4/N2 selectivity values were measured.

Corresponding author: Alina Vashchuk (alina.vashchuk@i.ua)

Vasyliev Ievgen [1], Ph.D., Associate Professor
Popov Stanislav [2], Ph.D., Associate Professor

[1]*Poltava National Technical Yuri Kondratyuk University*,
24, Pershotravneviy ave., Poltava, 36011, Ukraine;

[2]*Poltava State Agrarian University*,
Scovorody str., 1/3, Poltava, 36003, Ukraine

SECTION: *Strategies and modern technologies in road transport.*

Design of a Modernized Ppneumatic Gun for Spraying Liquids

The covered topic is very relevant in today's world. Spraying liquids is an important process in many industries, such as the automotive, electronics, aerospace, food and pharmaceutical industries.

One of the primary tools for spraying liquids is air guns, which use compressed air to create a flow of liquid. In order to improve the productivity and quality of spraying, it is necessary to constantly modernize and improve their designs.

The changes made in the design will allow to reduce energy consumption and lower emissions into the atmosphere, which in turn will have a positive effect on the environment and people's health.

Corresponding authors:
Vasyliev Ievgen (vas.eugene@gmail.com)
Popov Stanislav (stanislav.popov@pdaa.edu.ua)

Vinnichuk Kateryna
Vorobyova Victoria

National Technical University of Ukraine
«Igor Sikorsky Kyiv Polytechnic Institute»,
37, Prospect Peremohy, 03056, Kyiv-56, Ukraine

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Production of Gold Nanoparticles Using Grape Pomace Extract Obtained by LES (Low-temperature Eutectic Solvent)

The paper presents a "green" method of obtaining gold nanoparticles (GNPs) using grape pomace extract obtained with a low-temperature eutectic solvent (LES) based on proline and lactic acid. Grapes contain many polyphenolic compounds that are capable of reducing gold ions with the formation of colloidal nanoparticles. To characterize the composition of the grape extract, the HPLC separation method (high-performance liquid chromatography) was used, the results of which confirmed the high content of polyphenols in it. The size and shape of the obtained gold nanoparticles were characterized by scanning electron microscopy.

Corresponding author:
Vinnichuk Kateryna (vengerd18@ukr.net)

Yaremchuk Ivan, Postgraduate

Lutsk National Technical University,
75, Lvivska St., Lutsk, 43018, Ukraine

SECTION: *Modern research and prospects for the development of mechanical engineering.*

Study of Vibro-cutting Device Control Systems with CNC to Improve their Efficiency

Structural calculation scheme of the hydropulse device for vibration cutting with CNC with built-in ring pressure pulse generator is considered. On the basis of the structural scheme and cyclogram of the working cycle of the device, its dynamic and mathematical models were developed, in which the hydraulic link is represented by a visco-elastic model of the working fluid (energy carrier) composed of the inertial elastic and dissipative elements.

Corresponding author:
Yaremchuk Ivan (kpm@lntu.edu.ua)

Zaleta Olha, Ph.D., Associate Professor
Povstyanoy Oleksandr, D.Sc., Professor
Zaleta Andrii, Postgraduate

Lutsk National Technical University,
75, Lvivska St., Lutsk, 43018, Ukraine

SECTION: *Modern research and prospects for the development of mechanical engineering.*

Modeling of the Technological Equipment Operation Using the Petri net Method

This study is aimed at building a model of the functioning of a technological machine. Modeling begins with the formalization of initial data, for which it is necessary to analyze the structure and principle of operation of a typical layout of a machine of a given purpose and to display the interdependence between the nodes (modules) of the machine and the technological operations performed by it. With the help of the presented method, the regularity of the alternate activation of the machine modules is shown. The presented model can be the basis for programming the machine and controlling its operation. The proposed algorithm can be used to simulate the functioning of modular equipment regardless of its purpose.

Corresponding author:
Zaleta Olha (o.zaleta@lutsk-ntu.com.ua)

Zhao Junjun[1], Ph.D., Senior Researcher
Korzhyk Volodymyr [1], D.Sc., Professor, Corresponding Member of the NAS of Ukraine
Stukhliak Petro [2], D.Sc., Professor
Berdnikova Olena [1], D.Sc., Senior Researcher
Lepilina Kseniia[1]
Skackov Ihor [1], Ph.D., Associate Professor

[1] *Zhejiang E.O.Paton Welding Technology Research Institute*,
13th floor, Hangzhou Bay Wisdom Valley, №233,
Yonghui Road, Xiaoshan district, Hangzhou, Zhejiang, China;

[2] *Ternopil Ivan Puluj National Technical University*
56, Ruska St., Ternopil, 46001, Ukraine

SECTION: *Physical, chemical, technological properties of materials and their structure.*

Development of Wear-Resistant Ceramic Coatings for Implants Applied by Detonation Spraying

Implants made of inorganic materials are used to restore the functions of bone elements of the musculoskeletal system of the human body. They include both movable and non-movable structures (joints, vertebrae, dental prostheses, intraosseous plates) that replace the functions of bone formations that have already been lost for various reasons. One of the primary requirements for the use of synthetic implants is their long-term biocompatibility. In this direction of scientific research, it is important to determine the conditions for the formation of the transition zone, which is formed at the point of contact of living tissue and the implant.

The method of multi-chamber high-speed sputtering was used to implement the tasks. Offered coatings with increased strength of adhesive joints, wear resistance, hardness and contact strength for endoprostheses and dental implants. The parameters of the detonation sputtering process during the formation of coatings were studied.

Corresponding authors:
Stukhliak Petro (stukhlyakpetro@gmail.com)
Lepilina Kseniia (leksmih@gmail.com)

Zozulya Valerii [1], Ph.D., Associate Professor
Sergey Osadchy [2], D.Sc., Professor
Oleg Ternavskyi [1]

[1] *State University of Trade And Economics,*
19, Kyoto St. Kyiv, 02156, Ukraine;

[2] *Flight Academy of the National Aviation University*,
1, Chobany Stepana St., Kropyvnynskyi, 25005, Ukraine

SECTION: *Design of mechatronic systems.*

Development of an Embedded Controller of the Software Motion Control system of the Stewart Platform

In the present day, many fields of science and technology are actively creating position stabilization systems based on the Stewart platform. To control the mechanical part of the Stewart platform, programs were proposed to be used that were created in the LabVIEW environment with the SoftMotion, Real Time, and FPGA modules. As a result of the conducted research, the stages of designing such a controller have been shown, with the presentation of the design results in the form of software applications and a hardware implementation diagram of the control system.

Corresponding authors:
Valerii Zozulya (irish38@ukr.net)
Osadchy Sergey (srg2005@ukr.net)

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Oleksandr Povstyanoy
Olha Zaleta
Bohdan Valetskyi

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