Research monograph

Research papers

Materials

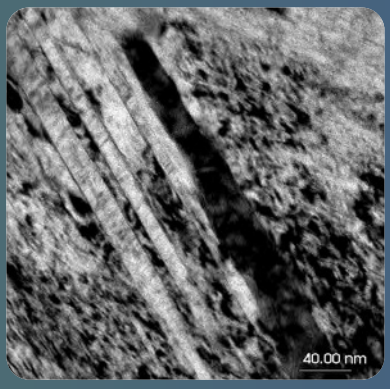
125

The Research monograph section represented by W. Kwaśny on "Predicting properties of PVD and CVD coatings based on fractal quantities describing their surface" on a **page 125** presents a methodology giving a possibility to predict properties of coatings reached in PVD and CVD processes on tool materials, based on fractal quantities describing their surface. Coatings' topography and its structure which has an impact on a shape of analysed objects' surface was characterised in a comprehensive way. Influence of a type of process and conditions of deposition over structure and shape of topography as well as mechanical and operational properties of the acquired coatings were determined. The coatings selection, representative in terms of types and conditions proceeding in deposition processes, types of substrates material as well as chemical and phase composition, and also a combination of applied layers provided diversity of their surface topography as well as mechanical and functional properties. Methodology for precise description of coatings topography acquired in PVD and CVD process on tool materials including utilisation of the fractal and multi-fractal geometry on the basis of images obtained on a atomic forces microscope was elaborated and verified. A modified methodology to determine fractal parameters of surface by means of the Projective Covering Method (PCM) was presented in details. Dependencies between fractal and multi-fractal parameters characterising analysed PVD and CVD coatings surfaces and their mechanical and operational properties were established. Values of the fractal dimension for coatings' topography received in the magnetron PVD process were correlated with microhardness and erosion resistance, whereas the fractal dimension values of coatings' topography obtained in the high-temperature CVD process (on a substrate made of Si3N4 ceramics and when the outer layer was made of Al2O3) and in the arc PVD process was correlated with tool life increase specified in the cutting ability test. It was shown that the presented interdependencies give a possibility to predict coatings' properties received in the PVD & CVD processes on tool materials based on fractal parameters defining their surface.

Appendix

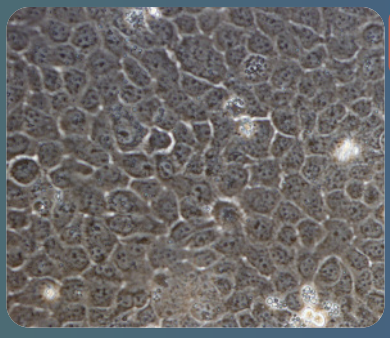
The integral part of this Issue is monograph publication in Polish of Dr W. Kwaśny entitled: „Prognozowanie własności powłok PVD i CVD na podstawie wielkości fraktalnych opisujących ich powierzchnie"

Selected materialographical photo



213

The research paper entitled "Structure and properties of the gradient tool materials based on a high-speed steel HS6-5-2 reinforced with WC or VC carbides" by L.A. Dobrzański and A. Kloc-Ptaszna on a **page 213** presents the manufacturing and researching a new group of the gradient tool materials, manufactured by a conventional powder metallurgy method, consisting in compacting a powder in a closed die and sintering it. On the basis of the results of the research, it was found that it was possible to obtain gradient materials by the powder metallurgy methods, in order to ensure the required properties and structure of the designed material. It was shown that the new sintered graded materials were characterised by a multiphase structure, consisting of ferrite, primary carbides of the high speed steel, of the MC and M6C type, and dependently of the reinforcement phase, of the tungsten carbide WC or the vanadium carbide VC, which were introduced into the material, in the form of powder. The materials were obtained by mixing the powders of the HS6-5-2 high-speed steel, tungsten carbide (WC), and vanadium carbide (VC). The mixes were poured one by one into the die, yielding layers with the gradually changing volume ratio of carbides within the high-speed steel matrix. Structural research by using the scanning and transmission electron microscopes, x-ray microanalysis and density, hardness and porosity tests, were performed. Structure and hardness of selected materials after heat treatment were also investigated. The material presented in this paper has layers consisting of the carbide-steel with growing hardness on one hand, and the high-speed steel, characterised by a high ductility on the other.



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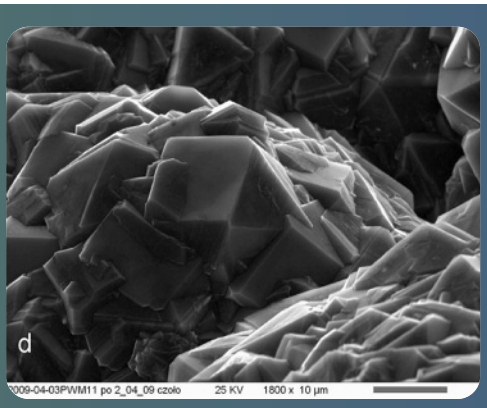
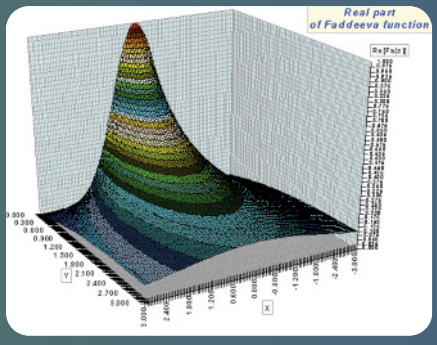
The paper from Materials area made by T. Burleson, N. Yusuf and A. Stanishevsky on "Surface modification of nanodiamonds for biomedical application and analysis by infrared spectroscopy" on a **page 258** inform that diamond nanoparticles gain much interest in biomedical applications due to the attractive chemical and biological properties. Studies have shown the potential of these "nanodiamonds" (NDs) for bioimaging, drug delivery, and biosensing. However, depending on the origin, the nanodiamond surface is often rich in various functional groups which can result in diverse behaviours in biological environments ranging from bioinertness to changes in cell function and cytotoxicity. We have observed the substantial difference in cellular response of several cell lines to NDs of various origins. Therefore, the aim of this study was to modify nanodiamond surface in a controlled manner to discriminate the effect of different functional groups on the cellular response. Many potent drugs that have proven to be useful in treating diseases such as cancer pose a challenge in delivery because they are not soluble in polar protic solvents such as water. These drugs are soluble in polar aprotic solvents that are harmful to the body. Nanodiamond surface modification in conjunction with drug-loading is a potential solution to this problem as nanodiamonds are nontoxic and have the ability to transport significant amounts of drugs. Nanodiamond particles are considered nontoxic and capable of absorption of a variety of organic molecules. This study should further advance the knowledge on the potential of surface-engineered NDs in therapeutic and drug delivery applications.



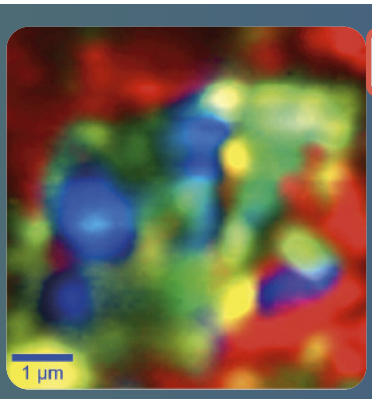
264

The Materials section represented by K. Fabisiak and E. Staryga on "CVD Diamond: from growth to application" on a **page 264** presents a short review of basic diamonds properties and indicate possibilities of different applications of this material. As an example, the application of CVD (Chemical Vapour Deposition) diamond layer in electrochemistry was shown. It was shown that it is possible to synthesize the diamond layers of different morphology and quality. Raman microprobe measurements showed that quality of diamond films deposited by HF CVD method reflect their morphology. CV measurements showed that the fabricated electrodes had wide potential window almost twice bigger in comparison to the classical Pt electrode. CVD diamond (synthetic diamond made by a chemical vapour deposition process) is an important family of materials used in microelectronic and optoelectronic packaging and for laser and detector windows. Its ultra-high thermal conductivity enables to increase microprocessor frequency and output power of microelectronic and optoelectronic devices. Diamond is resistant to chemical attack and chemical sensors based on the fact it can work in harsh environment. The paper underlines an important role of diamond films as a promising material for production of electrodes for electrochemical applications.

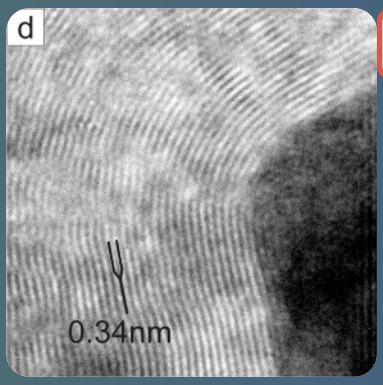


270

In the paper entitled "Raman spectra evaluation of the carbon layers with Voigt profile" by M. Gołąbczak and A. Konstantynowicz on a **page 270** the use of Raman spectroscopy as the valuable tool for investigations of the content and state of different material samples has been presented. Not only qualitative analysis but also quantitative one is in the scope of this method which in turn demands use of precise mathematical tools for describing spectrograms. Good computational tools for generation of the Voigt profile, being not an analytical function itself and good understanding of mutual relationships between the Voigt profile and the Fabry-Pérot interferometer is of main interest for not only practical but also precise use of this tool for quantitative analysis of Raman spectra. So-called Voigt profile establish basis for the relatively most precise shape-functions used for describing spectrogram shape. Voigt profile is the convolution of the very well known distribution functions: Gaussian distribution and Cauchy distribution (Lorentz distribution). Gaussian distribution is traditionally recognised as a tool for modeling multi-causal phenomena due to the Central Limit Theorem results. Cauchy distribution is recognised as modeling influence of the Fabry-Pérot interferometer (etalon) used for detection of the Raman spectrum. The main goal of work has been the thorough preparation for future works with spectrum deconvolution allowing better resolution in determining Raman spectrum components.

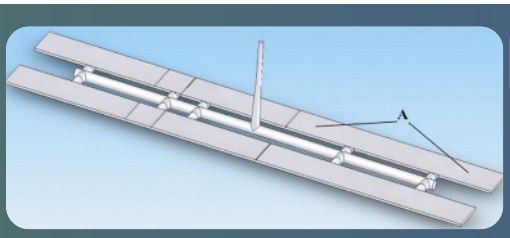


The Materials section represented by A. Karczemska, T. Jakubowski and F. Vergas on "Different diamonds in meteorites – DaG 868 and NWA 3140 ureilites" on a **page 292** presents two ureilites: NWA 3140 and DaG 868. The aim of this paper is to show the non-uniformity of carbon in ureilites, especially differences of ureilitic diamonds. One of the best methods to examine different allotropic forms of carbon is Raman Spectroscopy. This method used to investigate diamonds provides a lot of information about diamond polytypes, crystals sizes, a level of defects and internal stresses, etc. 2D imaging was done with a Confocal Raman Imaging alpha 300 R WITec apparatus equipped with an Nd:YAG laser with 532 nm excitation. The spectra were collected with a high-sensitive confocal microscope connected to a high-throughput spectrometer equipped with a CCD camera. Mean and local elemental compositions of the samples were determined by an energy dispersive X-ray (EDX) method. A scanning electron microscope HITACHI S-3000 N was used to characterise microstructures (carbon veins) of the samples. Different diamond generations were found in ureilites in the presented research with a wide range of Raman shifts from 1309 cm -1 to 1339 cm -1. Also graphite and amorphous carbon were found. Understanding diamonds and the other carbon phases in meteortites could help in manufacturing new carbon materials in laboratory.



The paper entitled "Nanostructural C-Pd coatings obtained in 2-steps PVD/CVD technological process" presented by M. Kozłowski, E. Czerwosz, P. Dłużewski, E. Kowalska, J. Radomska and H. Wronka on a **page 304** shows the scanning electron microscopy (SEM) and transmission electron microscopy (TEM) investigation results of nanoporous coatings based on palladium and carbon, obtained in two steps process – first step – physical vacuum deposition (PVD) and second step chemical vacuum deposition (CVD). Pd Content included in the volume of a coating obtained in PVD process affects on a distribution and sizes of Pd nanocrystals. The diameter of Pd nanocrystals obtained for coatings with lower Pd content is lower than for coating with higher Pd content. Modification of these coatings in CVD process at temperature of 650°C leads to obtain a different form of the final coating: for coating with lower content of Pd, the CVD process causes formation of nanoporous C-Pd coating; for coating with higher Pd content, formation of bigger Pd crystals is found. Temperature higher than 650°C leads to coatings growth with nonporous structure. Obtained coatings can be used as active layer in hydrogen and hydrogen compounds sensors or in hydrogen storage applications.

Properties



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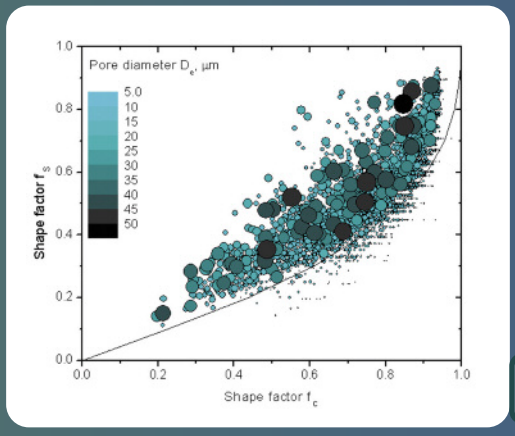
In the paper entitled "Some effects of multiple injection moulding on selected properties of ABS" by M. Żenkiewicz, P. Rytlewski, K. Moraczewski, M. Stepczyńska, T. Karasiewicz, R. Malinowski and W. Ostrowicki on a **page 361** the influence of multiple (up to 10 times) injection moulding of acrylonitrile-butadiene-styrene (ABS) on some properties of the obtained moulded pieces is presented. The investigated samples were obtained during the industrial injection moulding. There were determined the sample mechanical properties (by a tensile test), melt flow rate, temperatures of phase transitions (by differential scanning calorimetry, DSC), temperatures of thermal degradation (by thermogravimetric analysis, TGA), as well as storage modulus and damping coefficient (both by dynamic mechanical analysis, DMA). After the first injection mouldings, minor decreases (ca. 2.0%) in the tensile strength were observed. After the next injection mouldings, this quantity did not change much. The melt flow rate increased along with the number of injection mouldings. The glass transition temperatures (from DSC) of butadiene and acrylonitrile-styrene fractions do not vary with the number of injection mouldings and are ca. -61 and +104°C, respectively. It has been observed that the largest changes in the tensile strength and melt flow rate of ABS occur during its first injection moulding and a melt flow rate increases slightly with the number of injection mouldings. The temperatures of phase transitions and thermal as well as the storage modulus and damping coefficient of ABS do not essentially change after repeated injection mouldings.



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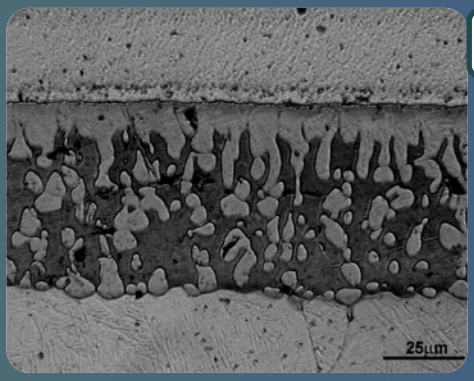
The paper entitled "The influence of sintering time on the properties of PM duplex stainless steel" by Z. Brytan, L.A. Dobrzański and M. Actis Grande, M. Rosso on a **page 387** demonstrates the effect of sintering time on the pore morphology, microstructural changes, tensile properties and corrosion resistance of vacuum sintered duplex stainless steel. In a presented study PM duplex stainless steels were obtained through mixing base ferritic stainless steel powder with controlled addition of elemental alloying powders and then sintered in a vacuum furnace with argon backfilling at 1250°C for different time periods. Produced materials were studied by LOM/SEM metallography and the pore morphology was characterised. The mechanical properties were studied in tensile, hardness and Charpy impact tests. The corrosion resistance was evaluated by means of salt spray test and immersion in sulfuric acid. Mechanical properties of obtained PM duplex stainless steels are very promising, especially with the aim of extending their field of possible applications. The possibility of obtaining balanced austenitic-ferritic microstructure of stainless steel using elemental powders added to a stainless steel base powder. The vacuum sintering of such powder mixture results in good microstructural homogeneity.



448

The paper from Properties area made by J. Nowacki and M. Kawiak on "Microstructure and characteristics of high dimension brazed joints of cermets and steel" on a **page 448** a state of the question concerning stresses in brazing joints of different physical and mechanical properties was appraised as well as possibility of their decrease due to use of different techniques from technological experiments to numerical methods. Evaluation of microstructure and mechanical properties of large dimensional vacuum brazed joints of WC – Co and Ferro Titanit Nicro 128 sinters and precipitation hardened stainless steel of 14 –5 PH (X5CrNiMoCuNb14-5) using copper and silver – copper as the brazing filler metal. Results of numerical calculations of two-dimensional models of brazed joints for different sizes of surfaces brazed at a constant width of solder gap are presented. Particular attention was paid to stresses occurring in joints of large brazing surfaces.
Results of the investigation proved that joints microstructure and mechanical properties depend on filler and parent materials, diffusion process during brazing, leading to exchange of the cermets components and filler metal as well as joint geometry (mainly gap thickness). The effect of joint geometry (soldering clearance size, inter-plate distance, plate geometric parameters) on its microstructure and the status of stresses and deformations as well as on the process of plate cracking has been determined.

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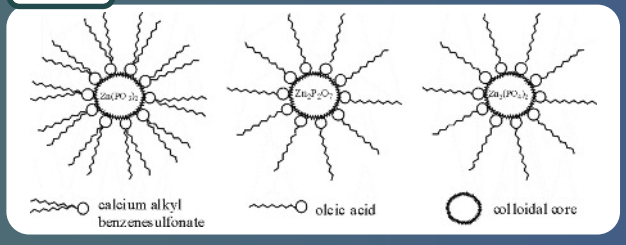
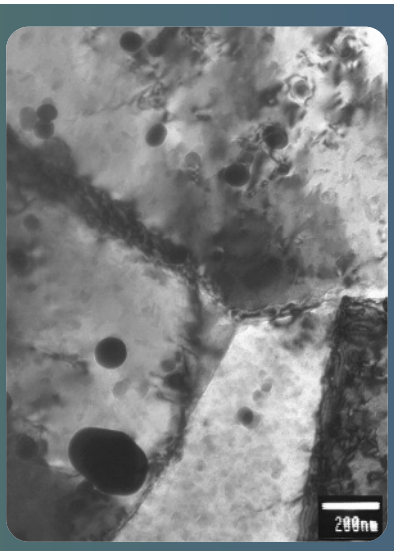


Authors: Z. Pawlak, P.K.D.V. Yarlagadda, R. Frost and D. Hargreaves in the paper entitled "The mechanical characteristics of phosphate glasses under high temperature and friction-induced cross-linking processes" on a **page 458** present mechanical properties of phosphate glasses under high temperature-induced and under friction-induced cross-linking, which enhance the modulus of elasticity. The addition of iron or aluminum ions to phosphate glasses under high temperature – and friction-induced amorphisation of zinc metaphosphate and pyrophosphate tends to provide more cross-linking and mechanically stronger structures. Iron and aluminum (FeO4 or AlO4 units), incorporated into phosphate structure as network formers, contribute to the anion network bonding by converting the P=O bonds into bridging oxygen. Future work should consider on development of new materials prepared by sol-gel processes, eg., zinc (II)-silicic acid. This paper analyses the friction pressure-induced and temperature-induced the two factors lead phosphate tribofilm glasses to chemically advanced glass structures, which may enhance the wear inhibition. Adding the coordinating ions alters the pressure at which cross-linking occurs and increases the antiwear properties of the surface material significantly.

Methodology of research

Analysis and modelling



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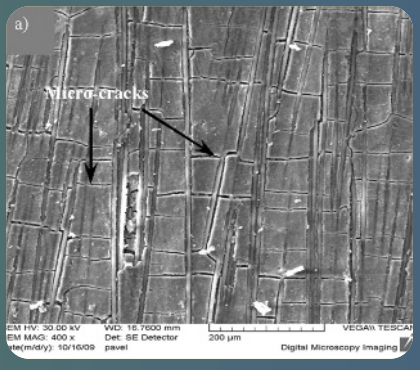
Authors: J. Stobrawa, Z. Rdzawski, W. Głuchowski and W. Malec in the paper entitled "Microstructure and properties of CuNi2Si1 alloy processed by continuous RCS method" on a **page 466** inform that precipitation strengthened copper constitutes a group of functional and structural materials used where combination of high electrical conductivity with high strength is required. A growing trend to use new copper-based functional materials is recently observed world-wide. Within this group of materials particular attention is drawn to those with ultrafine grain size of a copper matrix. This study was aimed to investigate mechanical properties and microstructure in strips of age hardenable CuNi2Si alloy processed by continuous repetitive corrugation and straightening (CRCS). Tests were performed with quenched (900°C/1hour/water) or annealed (650°C /1 hour) 0.8 mm thick strips using original die set construction (toothed rolls and plain rolls set) installed in tensile testing machine. The changes of mechanical properties (HV, ultimate tensile strength, 0, 2 yield strength) as well as microstructure evolution versus number of deformation cycles were investigated. The microstructure was investigated by optical and electron microscopy (TEM and SEM equipped with EBSD). The paper contributes to the mechanical properties of precipitation strengthened ultra fine grained copper – chromium alloy strips obtained by original RCS method and to the microstructure evolution.



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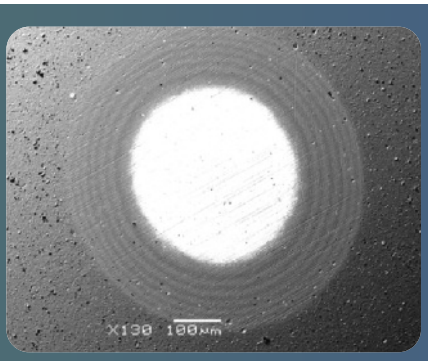
In the paper entitled "Effect of curing temperature on flexural properties of silica-based geopolymer-carbon reinforced composite" by D.H. Tran, D. Kroisova, P. Louda, O. Bortnovsky and P. Bezucha on a **page 492** the curing temperature at which it can achieve the best mechanical properties and adhesion between silica-based geopolymer matrix (Q1) and carbon HTS 5631 1600tex 24K fibre is presented. Relatively wide range of curing temperature from 70°C to 100°C at which we can obtain high flexural properties, maximal values of flexural strength 570 MPa, flexural modulus 65 GPa and relative deformation of composite was 0.98% when the composite was cured and dried at 75°C. Adhesion of the geopolymer matrix to carbon fibre was very good and hardly to determine the differences by SEM image observation within the range of optimal curing temperature. Determining the optimal curing temperature and micro-structure of silica-based geopolymer system to make it easy to find the curing time and other conditions to get the best properties of this type of materials. The research presents original information on the influence of different curing temperatures on mechanical properties and micro-structure of silica-based geopolymer matrix – carbon composite. The results are useful for further investigations.



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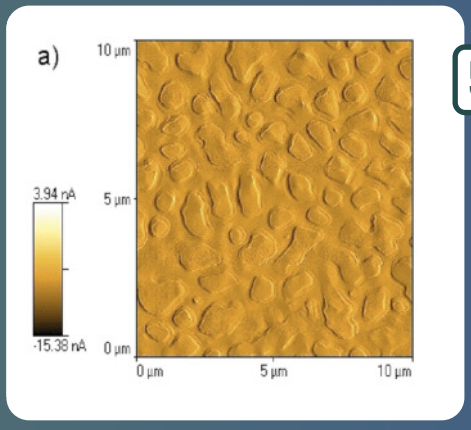
The paper entitled "Tribological properties of CrNx coatings" by B. Warcholinski and A. Gilewicz on a **page 498** shows the characterisation of the tribological properties thin Cr-N coatings, both monolayer Cr2N, CrN coatings and multilayer Cr/CrN, Cr2N/CrN coatings, deposited by cathodic arc physical vapour deposition (CAPVD). The main limitation of this work is linked to the deposition technique itself. It is difficult to avoid surface defects and pinholes that strongly influence the tribological results. Basing on the scratch test it was shown that the influence of the architecture on the coating' adhesion is dominant. It was found that the all tested coatings show high critical load Lc2 >70 N. The multilayer coatings show higher critical load when compared to monolayer coatings. The comparison of adhesion and wear resistance of mono- and multilayer coatings based on chromium. The deposition technology enable to obtain the coatings with high adhesion to the substrate. This may be important to advanced coatings industry. Chromium based coatings present good mechanical properties which allow them to be used in several applications; from decorative to protective coatings.



505

In the paper entitled "Studying of spin-coated oxad-Si properties" by J. Weszka, L.A. Dobrzański, P. Jarka J. Jurusik, B. Hajduk, M. Bruma, J. Konieczny and D. Mańkowski on a **page 505** the technical conditions of polymer thin film deposition by spin-coating techniques are presented. Thin films of about nanometres thickness were prepared by spin-coating and their properties were studied. Polymer thin films oxad-Si was used as material for preparation. The thin films were deposited with various spinning velocity from solution of different concentration. Thin films were deposited on BK7 glass and quartz substrates. The morphology and optical properties of Oxad-Si polymer thin films were described. This paper includes also description of the influence of deposition conditions on properties of polymer thin films. The value of this paper is to define the optimal parameters of spin-coating technology for preparing oxad-Si thin film with the best properties for optoelectronics appliances. This paper describes, using experimental polymer, material for spin coating technology. Results of these researches enable to develop the spin-coating technology.

Manufacturing and processing

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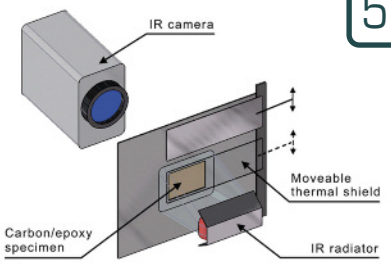

The Properties area is shown in the paper on "Determination of thermal diffusivity of carbon/epoxy composites with different fiber content using transient thermography" by G. Wróbel, Z. Rdzawski, G. Muzia and S. Pawlak on a **page 518**. The purpose of present study was to determine the thermal diffusivity of carbon fibre/epoxy composites with different fiber content using flash method. The originality of present investigation is in application of transient thermography based on flash method approach to measure thermal diffusivity of carbon/epoxy composites. The results obtained from present experiment would be of great importance in the industrial or laboratory applications to determine thermal diffusivity in carbon fibre reinforced composite materials. It was found from obtained results that composites with different carbon fiber content had different values of thermal diffusivity. The method initially proposed by Parker as "flash method" for the thermal diffusivity measurements of homogeneous solids was successfully applied to determine thermal diffusivity of CFRP composites. A relationship showed that the thermal diffusivity is linear function of carbon content in considered materials.

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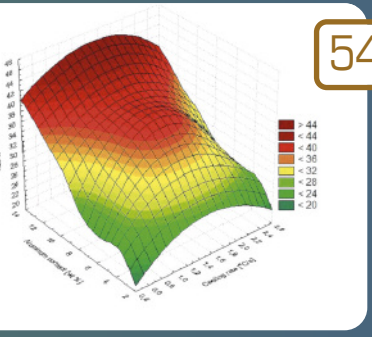
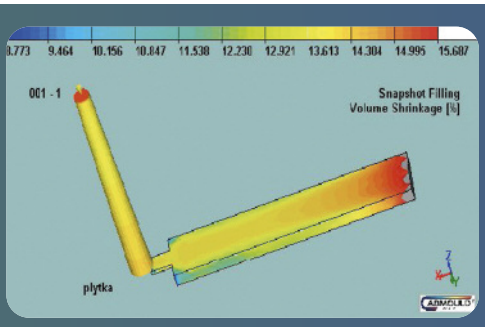


The paper from Analysis and Modeling area made by L.A. Dobrzański and M. Król on "Application of the neural network for Mg-Al-Zn mechanical properties modelling" on a **page 549** describes the results of the research connected with the development of a new approach based on the neural network to predict chemical composition and cooling rate for the mechanical properties of the Mg-Al-Zn cast alloys. The independent variables on the model are chemical composition of Mg-Al-Zn cast alloys and cooling rate. The dependent parameters are hardness, ultimate compressive strength and grain size. The experimental magnesium alloy used for training of neural network was prepared in cooperation with the Faculty of Metallurgy and Materials Engineering of the Technical University of Ostrava and the CKD Motory plant, Hradec Kralove in the Czech Republic. The alloy was cooled with three different cooling rates in UMSA Technology Platform. Compression test were conducted at room temperature using a Zwick universal testing machine. Compression specimens were tested corresponding to each of three cooling rates. Rockwell F-scale hardness tests were carried out using a Zwick HR hardness testing machine. Original value of the work is applied for the artificial intelligence as a tools for designing the required mechanical properties for Mg-Al-Zn castings.



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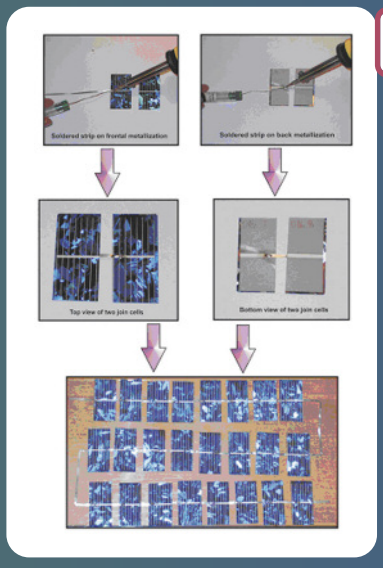
The paper entitled "Finite Element Method application for determining feedstock distribution during powder injection moulding" by A. Śliwa, G. Matula and L.A. Dobrzański on a **page 584** demonstrates the problem of modelling of a polymer-powder mix flow during filling, in which the high-speed steel was used along with paraffin and polypropylene as a binding agent. It was confirmed that using finite element method in powder injection moulding process can be a way for reducing the investigation costs. Results reached in this way are satisfying and in slight degree differ from results reached by an experimental method. However, for achieving better calculation accuracy in further researches a given model which was presented in this paper should be developed. Nowadays the computer simulation is very popular and it is based on the finite element method, which allows to understand better the interdependence between parameters of process and choosing an optimal solution. The possibility of application faster and faster calculation machines and coming into being many software make possible the creation of more precise models and more adequate ones to reality. The presented model meets the initial criteria, which gives ground to the assumption about its usability for injection moulding of polymer-powder slurry process, employing the finite element method using the Cadmould software. The computer simulation results correlate with the experimental results.



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The paper written by L. A. Dobrzański, A. Drygała and A. Januszka on "Formation of photovoltaic modules based on polycrystalline solar cells" on a **page 607** shows the formation of photovoltaic modules and analysis of their main electric parameters. The main goal of the research is to show the practical application of solar cells. Two photovoltaic modules were assembled and their basic electric properties were analysed. It was shown that they may be successively applied as an alternative energy source. The produced photovoltaic modules and photovoltaic systems confirm the utility of solar energy in every place where the sun radiation is available. Because of exhaust conventional energy sources like coal or earth gas, new renewable sources of energy (sunlight, wind) are more and more often used. It brings huge ecological benefits. In order to provide useful power for any application, the individual solar cells must be connected together to give the appropriate current and voltage levels. Taking this fact into account the analysis of photovoltaic module construction was performed. Photovoltaic modules are irreplaceable in areas which are far away from power network. Simply photovoltaic module can supply small device without any problem.

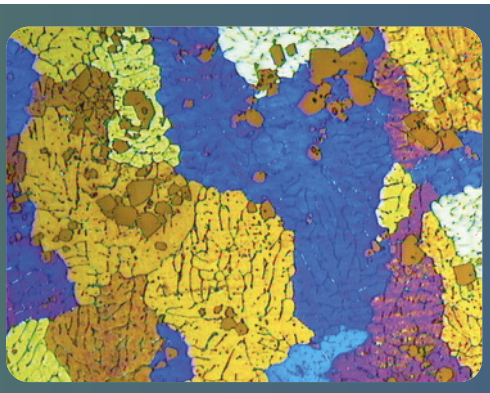
Industrial management and organisation

Education and research trends

Technical paper

Case study

Indexes



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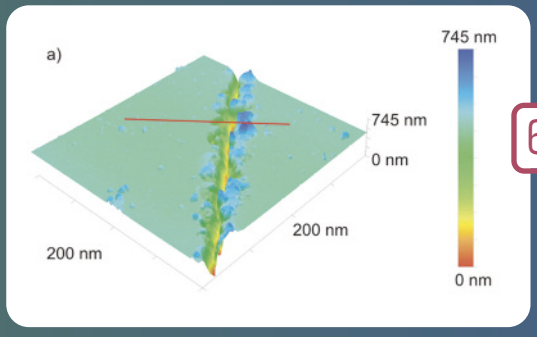
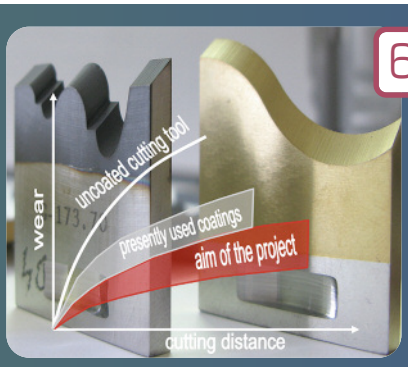
The paper written by L.A. Dobrzański, K. Labisz, R. Maniara and A. Olsen on "Microstructure and mechanical properties of the Al-Ti alloy with cerium addition" on a **page 622** shows the heat treatment influence, particularly solution heat treatment time to the changes of the microstructure, as well as to determine which intermetallic phases occur after the heat treatment performed, and what morphology of these particles is. The combination of light weight and high strength Ti-based alloys is very attractive for aerospace and automotive industries. Furthermore, the presence of calcium cerium into existence new unknown phases as well can enhance the thermal stability of ternary Al-Ti-Ce alloy because of its higher melting point then Al-Ti. The investigated aluminium samples were examined metallographically using optical microscope with different image techniques, scanning electron microscope and also analysed using a Vickers micro-hardness tester, also EDS microanalysis was made. As an implication for the practice a new alloy can be developed, some other investigation should be performed in the future, but the knowledge found in this research shows an interesting investigation direction.

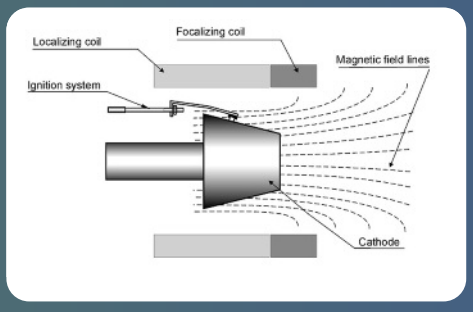


660

In the paper entitled "Multilayer, hybrid PVD coatings on Ti6Al4V titanium alloy" by W. Pawlak and B. Wendler on a **page 660** the hybrid PVD technology of deposition wear resistant, multilayer coatings onto diffusion-hardened Ti6Al4V titanium alloy is presented. Titanium and its alloys are desirable materials in modern constructions and vehicles. They have a high specific strength and very good corrosion resistance and biocompatibility. On the other hand, they have low load-bearing capacity and poor tribological properties, as, for example, high friction coefficient, low resistance to adhesive and abrasive wear and tendency to galling. Development of multiplex coatings depositions techniques is vital for expanding areas of titanium alloys usage. It was concluded from the results of investigations that not every proposed multilayer structure ensure good frictional properties of Ti6Al4V alloy even when the coating posses very high hardness. The lowest value of wear and friction coefficient was determined for multilayer coating with (TiC/C)x3 structure. Original value of this paper consists in use in one process of three different PVD techniques for coatings deposition: FCAE, RMS and PCAD. Moreover, the coatings were deposited onto diffusion hardened by interstitial oxygen atoms Ti6Al4V alloy. Multilayer coatings deposited by means of the hybrid PVD technique can be used for low friction and wear protection of titanium alloys.



Authors: J. Ratajski, W. Gulbiński, J. Staśkiewicz, J. Walkowicz, P. Myśliński, A. Czyżniewski, T. Suszko, A. Gilewicz and B. Warcholiński in the paper entitled "Anti-wear coatings for woodworking tools – a review" on a **page 668** present thorough analysis of the state-of the-art in the field of woodworking tools durability improvement. In comparison with the achievements of global leaders in the field, the technologies developed so far at the Institute of Mechatronics, Nanotechnology and Vacuum Technique, as well as the latest research works undertaken by the authors are presented. The specificity of machining conditions of wood and wood-derivative materials consists in simultaneous occurrence of very high working speed, extremely sharp cutting edges and high working temperature – on the one hand, and high anisotropy and low thermal conductivity of the machined material – on the other. The paper summarises various ways, including selection of both tool materials and surface treatments, applied in order to increase the productivity of woodmachining. A systematic analysis has been made on the type of tool materials suitable for machining of different sorts of solid wood and wood-derivative materials. It was shown that all woodworking tool types, except for satellites, require development of dedicated surface engineering technologies improving significantly their durability. The main features of CVD and PVD surface treatment technologies were compared in relation to their application for woodmachining tools.



The paper from Manufacturing and processing area made by J. Walkowicz, J. Smolik, R. Brudnias, B. Kułakowska-Pawlak and W. Żyrnicki on "Correlation between spatial distribution of the components of reactive plasma flow and the stoichiometry and defectiveness of deposited coatings" on a **page 712** describes the evolution, structure and location of arc spots on the cathode frontal surfaces of two types of industrial arc sources. The sources differed from each other in the arc ignition systems, cooling systems, cathode shapes and cathode spots localisation systems. The analysis of the recorded pictures revealed the fine structure of the arc discharge for the investigated range of process conditions. The cathode spot multiplicity varied from 1 (when discharge current was concentrated in a single spot) to 5 (when discharge current was split up into five simultaneously existing spots). Both temporal and spatial behaviour of cathode spots were different for both investigated arc sources. The correspondence between radial distributions of the cathode spots on the cathode surface and radial distribution of plasma flow elements analysed in the volume of the vacuum chamber was revealed. The originality of the research presented in the paper consists in assigning overall correlation between vacuum-arc source configuration and parameters of vacuum-arc discharge – on the one hand, and space-time behaviour of the arc spots during their movement on the circular cathode surface and radial distribution of excited and ionized atoms of the cathode material in the deposition chamber – on the other.