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309. Phases morphology and distribution of the Al-Si-Cu alloy
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The research paper entitled “Surface modification of nanodiamonds for biomedical application and analysis by infrared spectroscopy” on a page 258 informs 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 bioreactivity 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.
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369. Thermal stability and mechanical properties of sputtered Chromium-Molybdenum-Nitride (CrMoN) coatings
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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 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 indicates 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 synthesise 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.
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. Radomski 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 non-porous structure. Obtained coatings can be used as active layer in hydrogen and hydrogen compounds sensors or in hydrogen storage applications.
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R. Torz-Piotrowska, A. Wrzyszczynski, K. Paprocki, M. Szreiber, C. Uniszkiewicz, E. Starga (Poland)

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. Karasiwcz, R. Malinowski and W. Ostrawicki 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 +104ºC, 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.

The paper entitled “The influence of sintering time on the properties of PM duplex stainless steel” by Z. Brytan, L.A. Dobrzanski 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.
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Finite Element Method application for determining feedstock distribution during powder injection moulding

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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. Bortsevsky and P. Beuziu 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 520 MPa, flexural modulus 85 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 “Finite Element Method application for determining feedstock distribution during powder injection moulding” by A. Śliwa, G. Macula and L.A. Dobrzaniński 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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In the paper entitled "Multilayer, hybrid PVD coatings on Ti6Al4V titanium alloy" by W. Pawlak and B. Wender 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 deposition 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 possess very high hardness. The lowest value of wear and friction coefficient was determined for multilayer coating with TiC/Cix 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.
The paper from Manufacturing and processing area made by J. Walkowicz, J. Smolik, R. Brudnias, B. Kulekowska-Pawlak and W. Zymicki 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 localization 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 analyzed 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.