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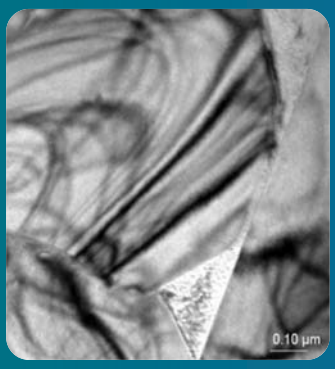
Selected materialographical photo

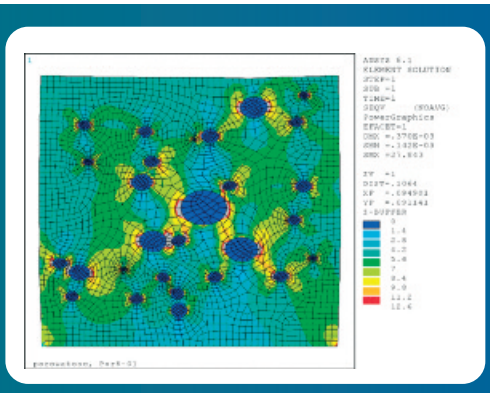


711

Authors: L.A. Dobrzański and B. Dołżańska in the paper entitled "Structure and properties of sintered tool gradient materials" on a **page 711** discuss the fabrication technology of novel sintered tool gradient materials on the basis of hard wolfram carbide phase with cobalt binding phase, and to carry out research studies on the structure and properties of the newly elaborated sintered tool gradient materials. The following research studies were carried out to elaborate a new group of sintered tool gradient materials, wolfram carbide with cobalt matrix, to elaborate their fabrication technology and to determine their structure and properties: a fabrication technology of mixtures and the formation technology of wolfram carbide gradient materials with cobalt matrix WC-Co was applied and elaborated; sintering conditions were selected experimentally: time, temperature and sintering atmosphere as well as isostatic condensation. The presented research results confirm that the newly elaborated technology of powder metallurgy, which consists in sequential coating of the moulding with layers having the increasing content of carbides and decreasing concentration of cobalt, and then sintering such a compact, ensures the acquisition of the required structure and properties, including the resistance to cracking and abrasive wear of tool gradient materials, due to earned high hardness and resistance to abrasive wear on the surface as well as high resistance to cracking in the core of the materials fabricated in such a way. The material presented in this paper is characterized by very high hardness of the surface and relative ductility of the core. TGM with smooth changes of the cobalt phase in the material.

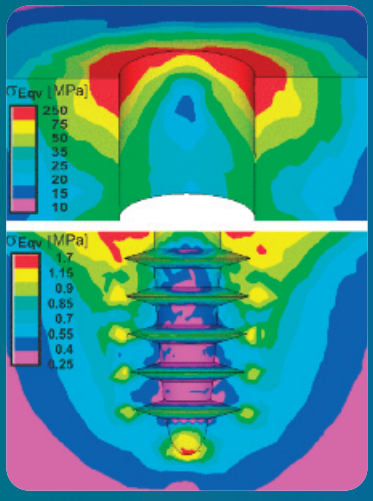
507

The research paper made by L.A. Dobrzański and W. Borek on "Hot-working of advanced high-manganese austenitic steels" on a **page 507** describes the investigation of newly elaborated high-manganese austenitic steels with Nb and Ti microadditions in variable conditions of hot-working. The investigated steels are characterized by high values of flow stresses from 230 to 450 MPa. The flow stresses are much higher in comparison with austenitic Cr-Ni and Cr-Mn steels and slightly higher compared to Fe-(15-25)Mn alloys. Increase of flow stress along with decrease of compression temperature is accompanied by translation of ϵ_{max} strain in the direction of higher deformation. Results of the multi-stage compression proved that applying the true strain 4x0.29 gives the possibility to refine the austenite microstructure as a result of dynamic recrystallization. In case of applying the lower deformations 4x0.23 and 4x0.19, the process controlling work hardening is dynamic recovery and a deciding influence on a gradual microstructure refinement has statical recrystallization. The steel 27Mn-4Si-2Al-Nb-Ti has austenite microstructure with annealing twins and some fraction of ϵ martensite plates in the initial state. After the grain refinement due to recrystallization, the steel is characterized by uniform structure of γ phase without ϵ martensite plates. The hot-deformation resistance and microstructure evolution in various conditions of hot-working for the new-developed high-manganese austenitic steels were investigated. The obtained microstructure – hot-working relationships can be useful in the determination of power-force parameters of hot-rolling and to design a rolling schedule for high-manganese steel sheets with fine-grained austenitic structures.



533

The Materials section represented by J. Nowacki and A. Sajek on "Modified bone cement microstructure numeric simulation" on a **page 533** the paper aimed at determining the strength of modified bone cement microstructure. Modification with aqueous hormone solution stimulates the growth of bone at a hip-joint endoprosthesis implantation site. Modification with aqueous solutions of modifying agents affects the structure and properties of bone cements. This is caused by formation of pores filled with aqueous solutions of modifying agents. This type of porosity decreases mechanical properties less than air-filled pores. Numerical simulation of the stress and displacement pattern in juncture microstructure should be expanded with a simulation of bone-cement-implant system operation, which will allow estimation of an optimum value of modifying agent admixture, i.e. a value enabling the improvement of juncture biocompatibility not lowering at the same time its mechanical properties below a level set up in standard specifications. Microstructure simulations performed confirmed a manner of modified cement cracking observed on fractures. They showed formation of pore agglomerations where concentrating stresses may bring about the appearance of dangerous micro-fractures. Cement modification with aqueous solution and examination of the effect of admixture on microstructure mechanical properties.

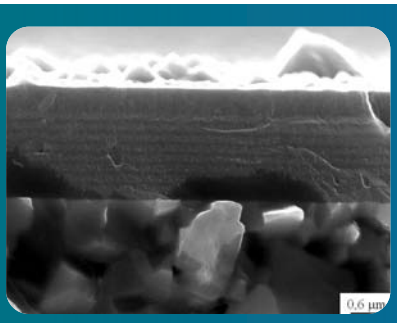


542

The paper entitled "Can typical overdentures attachments prevent from bone overloading around mini-implants?" by J. Żmudzki on a **page 542** informs that high level of successful maintenance of implants located in anterior part of mandible popularizes economical solutions of implant-retained soft tissue supported dentures including those using narrow mini-implants with small diameter – of 1,8-2,2 mm. FEM modeling analyses were used to determine distribution of mastication loads between mucous foundation and bone tissue surrounding mini-implants that have 1,8 mm diameter. Two types of commercial solitary denture attachments, described as biomechanically compatible due to their rotational movements freedom or due to the additional pivoting mobility were examined. While using mini-implants it is crucial to evaluate carefully the condition of bone foundation, due to the risk of quick development of atrophic processes in case of insufficient bone parameters. In a case of mini-implants very high strength value level and surface quality, due to the fact that in case of diameter of 1,8mm there might occur local yielding and propagation of fatigue cracks is very important. Commercial types of attachments do not deserve the name of mechanically biocompatible, as they do not allow for such significant reduction of overloading effects, as the non-commercial silicone attachments. In case of both types of attachments the most dangerous lateral implants loadings significantly exceed half of oblique mastication loads value. In mini-implants and bone tissue lateral forces generate a high level of stresses.

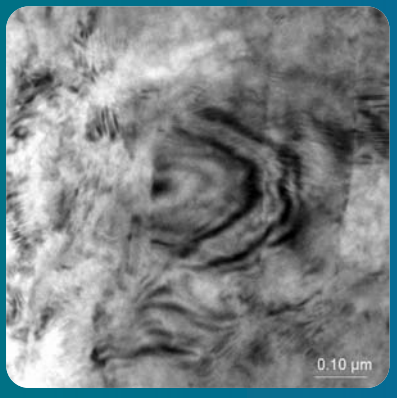
Methodology of research

Analysis and modelling



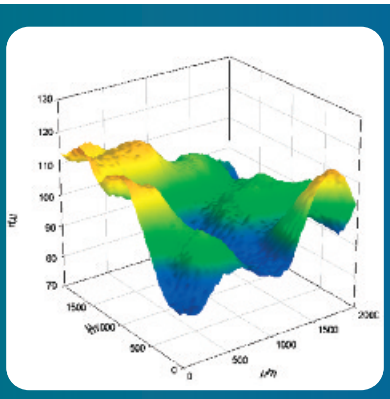
552

The paper written by L.A. Dobrzański and M. Staszuk on "PVD and CVD gradient coatings on sintered carbides and sialon tool ceramics" on a **page 552** informs about investigation of the structure and properties of multilayer gradient coatings produced in PVD and CVD processes on sintered carbides and on sialon ceramics, and to define the influence of the properties of the coatings such as microhardness, adhesion, thickness and size of grains on the applicable properties of cutting edges covered by such coatings. The investigation studies pertaining to the following issues were carried out: the structures of the substrates and coatings with the application of transmission electron microscopy; the structure and topography of coating surfaces with the use of electron scanning microscopy; chemical composition of the coatings using the GDOES and EDS methods; phase composition of the coatings using X-ray diffraction and grazing incident X-ray diffraction technique (GIXRD); grain size of the investigated coatings using Scherrer's method; properties of the coatings including thickness, microhardness, adhesion and roughness; properties of the operating coatings in cutting trials. The models of artificial neural networks which involve the dependencies between the durability of the cutting edge and properties of the coatings.Were worked out while selecting a proper coating material on ceramic cutting edges, it is advisable to remember that the coatings having the same type of atomic bond as the ceramic substrate have higher adhesion to the substrate. Another relevant aspect of the research presented in the paper is the fact that the adhesion of the coatings contributes significantly to the durability of the cutting edge, whereas the microhardness of the coatings, their thickness and grain size have a slightly lower influence on the durability of the tool being coated. The paper presents the research involving the PVD and CVD coatings obtained on an unconventional substrate such as sialon ceramics. Furthermore, to define the influence of coating properties on the durability of cutting edges, artificial neural networks were applied.



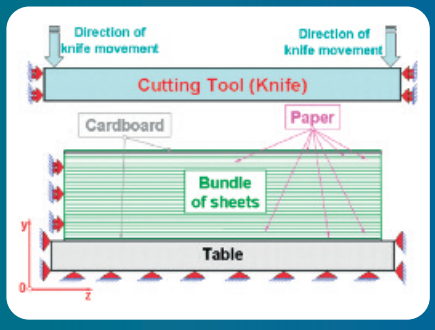
613

The paper entitled "Effect of cooling rate and aluminum contents on the Mg-Al-Zn alloys' structure and mechanical properties" by L.A. Dobrzański, M. Król and T. Tański on a **page 613** demonstrates influence of Al concentration and cooling rate on structure and mechanical properties of magnesium alloys. Also the paper presents a methodology to predict crystallization temperatures obtained during crystallization process using an UMSA platform, based on cooling rate and chemical composition and mechanical properties and grain size based on characteristics temperatures. The described parameters can be applied in metal casting industry for selecting magnesium ingot preheating temperature for semi solid processing to achieve requirements properties. The presented models can be applied in computer systems of Mg-Al-Zn casting alloys, selection and designing for Mg-Al-Zn casting parts. The research shows that the thermal analysis carried out on UMSA Technology Platform is an efficient tool to collect and calculate thermal parameters. The formation temperatures of various thermal parameters, mechanical properties (hardness and ultimate compressive strength) and grain size are shifting with an increasing cooling rate. The paper contributes to better understanding and recognition of an influence of different solidification condition on non-equilibrium thermal parameters of magnesium alloys.



634

The paper from Methodology of research area made by M. Kubisztal, A. Chrobak and G. Haneczok on "Non-destructive method of determination of elastic properties and adhesion coefficient of different coating materials" on **a page 634** describes a non-destructive method of determination of Young's modulus and adhesion coefficient of different coating materials (metallic coatings, polymer, composite etc.). Some results obtained by applying this method are discussed in details. It was shown that the application of the proposed approach to the metallic, polymeric and composite coatings allowed to obtain a quantitative data concerning the change of both the elastic properties and the adhesion coefficient with a change of: coating thickness, measurement temperature, chemical composition of coating, surface preparation or in the case of epoxy resin coatings with a change of curing time or curing temperature. The presented method consists in measuring the dynamic response of the examined material in the form of a flat rectangular bar subjected to external periodic mechanical stress i.e. the so called vibrating reed technique. General equations describing elastic properties of the sample consisting of a substrate and a deposited coating are derived and discussed in details. It was shown that the described method can be successfully used in optimisation of some technological processes of deposition of different coatings on metallic substrate. The proposed method can be applied in many scientific problems in the field of coating materials (e.g. elastic properties of porous coating, crystallization of amorphous coating, adhesion of different polymeric coatings).



657

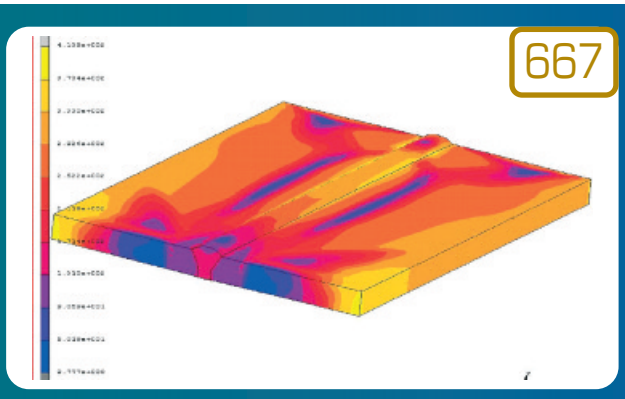
The paper written by J. Kaczmarczyk on "Optimisation of cutting velocity of bundles of various metal sheets on a guillotine with respect to heating process" on a **page 657** discusses methods and algorithms for thermal process optimisation during cutting the bundles of various types of metal sheets made of copper, brass and bronze interleaved with paper on a guillotine with respect to the heating process. Possibilities of designation of the optimum cutting parameters on account of maximum admissible temperature of the bundles of various metals were indicated. The constraints imposed on the temperature were needed to avoid defects which might occur in the direct cutting zone as the result of progressing heating during cutting. The numerical simulations were conducted using an author's computer programme prepared in the object oriented language C++ using the finite difference method. The optimisation has been conducted employing the genetic algorithms which were also implemented in C++ language and elaborated as an author's computer programme. As the objective function the maximum values of temperatures occurring in the direct cutting zone of the sheet bundles were assumed and the cutting velocity was established as a design variable. Optimisation of the cutting parameters is essential in terms of industrial economy. It allows to reduce the amount of waste caused by defects in cutting bundles of sheets and decrease wear of the cutting tool. Proposed elaborated methods and algorithms for optimisation of cutting parameters are novel and original tools supporting the reduction of defects' number occurring during cutting were designed.

Manufacturing and processing

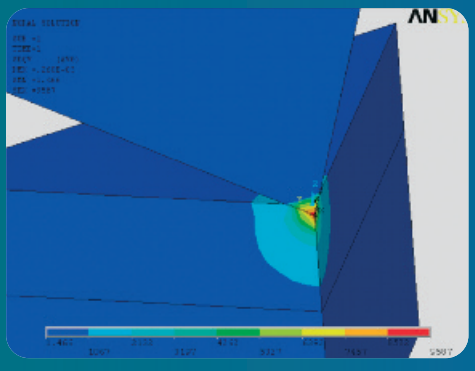
Industrial management and organisation

Education and research trends

Technical paper



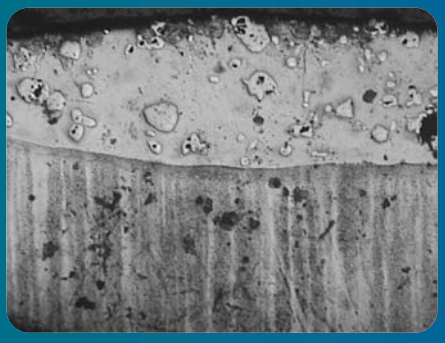
In the paper entitled "The evolutionary optimization of selected welded structures" by A G. Kokot, A. John and W. Kuś on a **page 667** the recent possibility of evolutionary optimization method application to predict the proper welding parameters in the weld process were determined. The objective of the welding simulation is to study the temperature generated during the welding process and to investigate residual stresses in the component after welding. Such results give the possibility to determine stress and strain state of welded parts and properties of materials in welding zones. From other side it gives the possibility to perform optimization process looking for welding parameters (welding speed, welding power source etc.) or initial shape of welded sheets according to displacement state (welding of thin metal sheets with stiffeners – T joints). Those results are also the basis for fatigue analysis. Computational simulation and evolutionary optimization give a lot of information very important for engineers. An undesirable side-effect of welding is the generation of residual stresses and deformations in the component and the quality of the weld has a substantial impact on the fatigue life of the structure. These resultant deformations may render the component unsuitable for further use. The presented grid based evolutionary optimization procedure is a new tool for better understanding and predicting the welding behaviour from the thermo-mechanical process point of view. It gives the possibilities to optimize main welding parameters in order to achieve better structures, taking into account nearly full set of welding parameters, temperature dependent material parameters and simulating the coupled thermo-mechanical problem.



The research paper made by A. Śliwa, L.A. Dobrzański, W. Kwaśny and M. Staszuk on "Simulation of the microhardness and internal stresses measurement of PVD coatings by use of FEM" on a **page 684** describes microhardness of coats and stresses obtained in PVD process with the use of finite elements method and comparative analysis with results obtained by laboratory investigations. The paper introduces the usage of finite elements method for simulation of microhardness and stresses measurement process in TiN and TiC coats obtained in magnetron PVD process on high-speed steel ASP 30. Simulation of indenters depression in investigated coat permitted on disclosure of deformation of the layer PVD and allows to create the maps of stresses. On the basis of tensions in investigated coat obtained in result of computer simulation effected in ANSYS software environment was possible to compute the microhardness of the coating, and the results was compared with the microhardness data of coats received by physical examination with use of the Vickers method. Basing on tensions obtained as a result of indenter depression in investigated surfaces, the maps of stresses, deformations analyzed of coats were obtained, and then microhardness was calculated.

743

The Manufacturing and processing area section represented by L.C. Vieira, R.H.Z. de Almeida, F.P.R. Martins and A.T. Fleury on "Application of computer vision methods to estimate the coverage of peen formed plates" on a **page 743** presents a simple method that allows for a systematic estimation of coverage of peen aluminum workpiece submitted to a peen form process. This approach is based on the application of computer vision techniques for segmenting amplified images of the shot peening processed surface. The work employed two combined methods of image segmentation – inductive algorithm generated rule segmentation and a multiagent segmentation system. Two combined methods of image segmentation allowed for an estimation of low coverage plates as well as done by human expert. Furthermore a model of the spatial shot distribution was also achieved. The model can be regarded as useful by accelerating the coverage evaluation in comparison with conventional industrial approach.



750

The Industrial management and organisation area is shown in the paper on "Foresight methods application for evaluating laser treatment of hot-work steels" by A.D. Dobrzańska-Danikiewicz, E. Jonda and K. Labisz on **page 750**. The purpose of this paper is to evaluate the strategic growth perspectives of laser treatment of X40CrMoV5-1 and 32CrMoV12-28 hot-work alloy tool steels using NbC, TaC, TiC, VC and WC carbide powders. The criterion assumed for dividing the technologies into groups was the powder type; thus, five groups were selected to realise researches. As a part of the foresight-materials science researches, a dendrological matrix of technology value, a meteorological matrix of environment influence, and a matrix of strategies for technologies were elaborated, the strategic development tracks were determined, and materials science experiments were conducted using a scanning electron microscope, an optical microscope, a transmission electron microscope, a microhardness tester, a scratch tester, an X-ray diffractometer, an electron microprobe X-ray analyzer and a device for testing of heat fatigue and abrasive resistance. Also, technology roadmaps were prepared. The presented results of experimental materials science researches prove the significant positive impact of laser treatment on the structure and the properties of hot-work alloy tool steels, which justifies including them in the set of priority innovative technologies recommended for use in small and medium enterprises and in other business entities. The value of this paper lies in the fact that it determines the value of laser treatment of hot-work alloy tool steels compared to other technologies and identifies the recommended strategic development tracks and technology roadmaps for them, taking into account the impact of such treatment on hardness, abrasion resistance, and coarseness of the tested surface layers.

We would like to kindly inform that in Vol. 43 / 1 (pp. 15-26) the paper which title is mentioned below was worked out by the team of authors as below. Previously, the name of one of the authors was omitted.

Providing the reliability of technical systems during the production process

Yu. Bobalo, L. Nedostup, M. Kiselychnyk
Theoretical Radioengineering and Radiomeasuring Department, Lviv Polytechnic National University, 12 S.Bandera Str., Lviv, Ukraine

The Editorial Team apologizes PT Authors and PT Readers for an ensuing situation resulting from a technical error.