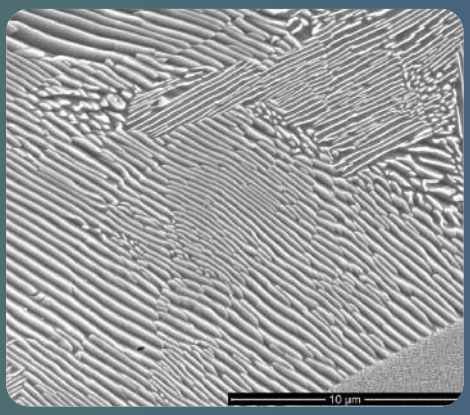
Research paper

Materials

Selected materialographical photo



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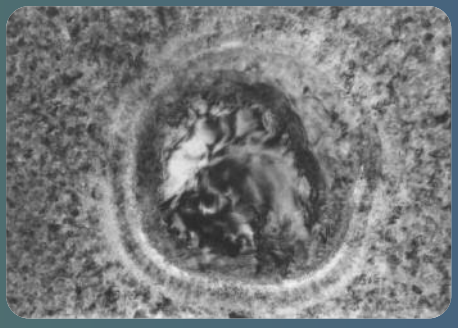
The Research paper by Z. Rdzawski, J. Stobrawa, W. Głuchowski and J. Konieczny on "Thermomechanical processing of CuTi4 alloy" on a **page 9** presents some utilitarian qualities since they can be used in development of process conditions for industrial scale production of strips from CuTi4 alloy of defined properties and operating qualities. One of the reasons behind the interest in copper titanium alloys was development of new materials to substitute beryllium copper. The reason for selecting that material for studies was that in the early stages of decomposition of CuTi4 alloy a spinodal transformation takes place and ordering processes begin. A proper selection of heat treatment and plastic working conditions provides possibilities to produce very wide ranges of sets of properties by formation of the required alloy microstructure. Therefore the main objective of the study was to capture the changes in precipitation kinetics, especially in the relations between supersaturation and ageing and between supersaturation, cold deformation and ageing in connection to the changes in microstructure and functional properties (mainly changes in hardness and electrical conductivity). The mentioned factors influence the mechanism and kinetics of precipitation and subsequently the produced wide ranges of functional properties of the Cu-Ti alloys.



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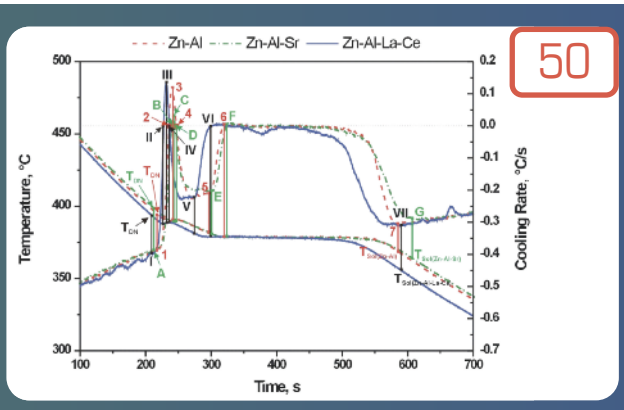
Authors: L.A. Dobrzański, A. Śliwa, L.W. Żukowska, J. Mikuła and K. Gołombek in the paper entitled "Structure and mechanical properties of PVD coatings for tool materials" on a **page 33** discuss the properties of (Ti,Al)N, Ti(C,N) and (Ti,Al,Si)N coatings, deposited on cemented carbide and cermet substrates. Deposition of hard, thin, multicomponent coatings on materials surface by PVD method features one of the most intensely developed directions of improvement of the working properties of materials. Employment of introduced combinations of substrates and coatings make it possible to transit of machining of semi-products from roughing to semi-finishing or finishing in one setting. Coatings based on (Ti,Al)N, (Ti,Al,Si)N as well as Ti(C,N) were developed to provide better performance over titanium nitride since the incorporation of aluminum or carbon in TiN increased hardness, decreased coefficient of friction of the coatings. Tools with such coatings reveal a significant life extension in service compared to the uncoated tools or coated with simple coatings based on monolayers of nitrides or carbonitrides, improvement of the tribological contact conditions in the tool-chip-machined material contact zone, and protection of the tool edge from oxidation and extensive overheating. The results of the out carried investigations confirm the advantages of PVD coatings deposited onto both: cemented carbides and cermets, especially in case of (Ti,Al)N and (Ti,Al,Si)N coatings. Coatings deposited onto the investigated substrates are characterised by good adhesion, high microhardness, taking effect in very high increasing of wear resistance.



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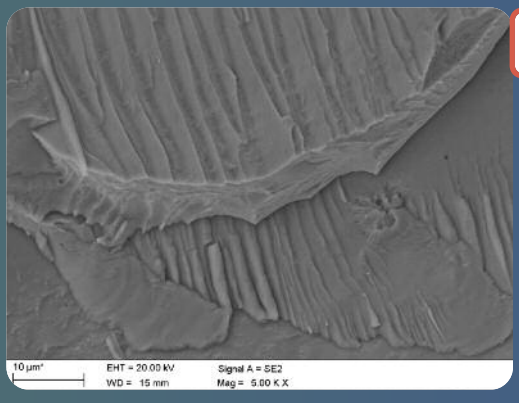
The Materials area is shown in the paper on "Crystallisation kinetics of Zn alloys modified with Ce, La, Sr, Ti, B" by B. Krupińska, K. Labisz, L.A. Dobrzański and Z. Rdzawski on a **page 50**. This paper presents the investigation results of cooling rate influence on microstructure of the Zn-Al cast alloy. Thermo-derivative analysis of the investigated alloys was performed using the UMSA (Universal Metallurgical Simulator and Analyzer device. This device makes it possible to characterise the important points of the crystallised alloy diagram including: phase and eutectics crystallisation, as well liquidus/solidus points. The material used for investigation was the ZL8 alloy. This work provides better understanding of the thermal characteristics and processes occurred in the new developed alloy. The achieved results can be used for liquid metal processing in science and industry and obtaining of a required alloy microstructure and properties influenced by a proper production conditions. The investigated material can find its use in the foundry industry; an improvement of component quality depends mainly on better control over the production parameters.



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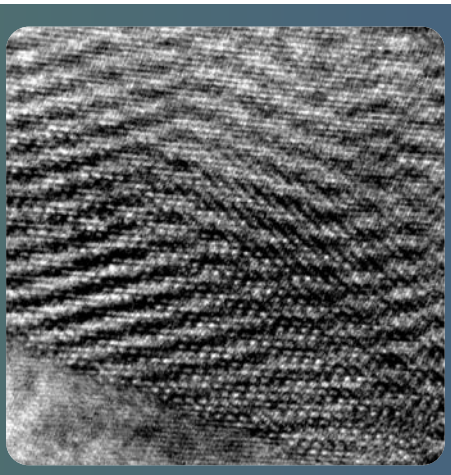
In the paper entitled "Structure and properties of Fe-Cr-Mo-C bulk metallic glasses obtained by die casting method" by W. Pilarczyk, R. Nowosielski and A. Januszka on a **page 81** the structure and properties of $Fe_{54}Cr_{16}Mo_{12}C_{18}$ alloy rods with different diameters obtained by the pressure die casting method are presented. Master alloy ingot with compositions of $Fe_{54}Cr_{16}Mo_{12}C_{18}$ was prepared by induction melting of pure Fe, Cr, Mo, C elements in argon atmosphere. The investigated material were cast in form of rods with different diameters. Glassy and crystalline structures were examined by X-ray diffraction. The microscopic observation of the fracture morphology was carried out by the SEM with different magnification. The thermal properties of the studied alloy were examined by DTA and DSC method. It is difficult to obtain a metallic glass of $Fe_{54}Cr_{16}Mo_{12}C_{18}$ alloy. The investigations carried out on the different samples of $Fe_{54}Cr_{16}Mo_{12}C_{18}$ bulk metallic alloy allowed to state that the studied ribbon was amorphous whereas rods were amorphous – crystalline.

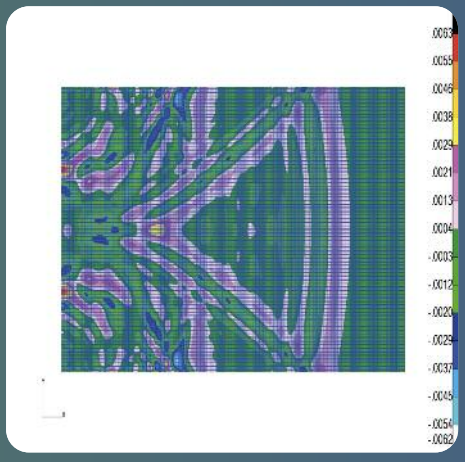
Properties

Analysis and modelling

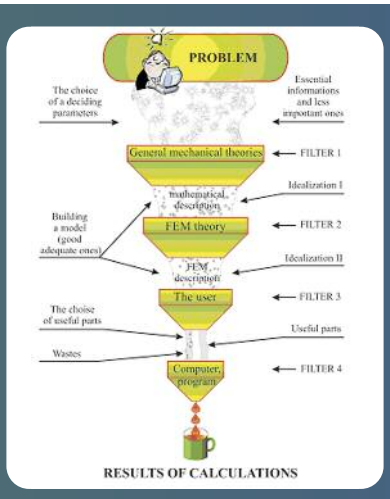
Manufacturing and processing



The Materials section represented by T. Tański, L.A. Dobrzański and K. Labisz on "Investigations of microstructure and dislocations of cast magnesium alloys" on a **page 94** presents the microstructures and the dislocation arrangements in the cast magnesium alloy. In this paper also the results of phase morphology investigation of an new developed Mg alloy are presented. Such studies are of great interest for the metal industry, mainly the automobile industry, were the improvement of cast elements quality is crucial for economic and quality reason and depends mainly on properly performed controlling process of the production parameters. There are presented especially the effect of heat treatment on the size and distribution of the precipitation occurred in the matrix. During the investigation dislocation networks are found to increase with deformation in all cases. The dislocation networks have been found in the γ- Mg17Al12 phase as well as in the matrix in the investigation magnesium alloys. The crystallographic orientation relationship are: (1 01) α-Mg ‖ (10) Mg17Al12 and (11 0) α-Mg ‖ (111) Mg17Al12. Precipitation of the γ-Mg17Al12 phase are mostly of the shape of roads, and the prevailing growing directions are the directions <110> α-Mg. The originality of this work is based on applying of regulated cooling rate of magnesium alloy for structure and mechanical properties changes. In this work the dependence between the regulated heat treatment, chemical composition and structure of the investigated magnesium cast alloy on the basis of the structure investigations was presented.



The research paper entitled "A computer model of the process of polymer materials fatigue destruction" by G. Wróbel on a **page 127** demonstrates an evolutionary model of fatigue destruction. The aim is in as much as possible faithful modeling of processes during constructional materials exploitation observed, particularly progressing of strength ability loss or other useful characteristics changes. The MES was chosen as a discretisation method. The model evolution goes sequentially – chaotic system modification by actual state analysis is preceded. An evolution stage and material state characteristics evaluation give a basis of destruction extend nondestructive evaluation. A new approach to the problem of investigation of polymeric composite's fatigue destruction has been demonstrated by means of computer simulation procedure. The developed method should be of interest to the industrial quality control applications and forecasting of important mechanical characteristics of composite materials, exploited in fatigue conditions. The obtained results would be of considerable importance in the computer aided diagnostic method of polymer composite materials.



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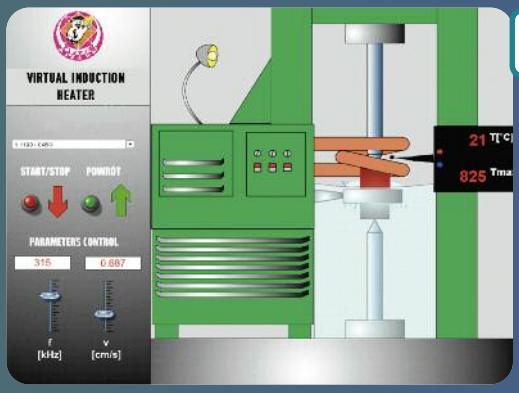
Authors: L.A. Dobrzański, A. Pusz, A.J. Nowak and M. Górniak in the paper entitled "Application of FEM for solving various issues in material engineering" on a **page 134** discuss problems concerning the application of Finite Element Method in materials engineering on the example of chosen programme which makes the most of this method to simulation. The application of FEM method during working out the internal prosthesis of oesophagus which will enable to help people suffering from oesophageal cancer. The method must be applied very carefully because its results do not refer to a real system but only to a model one. The obtained results of FEM calculations can be used to solve many problems at the early step of designing with success. A description of the importance and the utility of FEM during solving of problems dealing with very complicated geometry complex state of loadings, various boundary conditions and/or various materials.



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The Education and research trends area is shown in the paper on "The idea of material science virtual laboratory" by L.A. Dobrzański and R. Honysz on a **page 196**. A presented laboratory is an open scientific, investigative, simulating and didactic medium helpful in the realisation of the scientific and didactic tasks in the field of materials science. This laboratory is implemented in the Institute of Engineering Materials and Biomaterials of the Silesian University of Technology in Gliwice, Poland. The laboratory is an aggregate of testers and training simulators, placed in the virtual reality and created in various languages and the programming techniques, which represents the properties, functionality and manual principles of real equipment installed and accessible in the real laboratories of scientific universities. Application of the equipment, that is practically imperishable, cheap in exploitation and easy in the use encourages students and scientific workers to independent audits and experiments in situations, where the possibilities of their execution in the real investigative laboratory will be limited because of the high material costs, difficult access to real equipment or the possible risk of his damage. The project of the virtual laboratory corresponds with the global tendency for expand the investigative and academic centres about the possibilities of training and experiments performance with use of the virtual reality. This enriches investigation and education programmes of the new abilities reserved so far exclusively for effecting only on real equipment.

Cleaner production and biotechnology

Education and research trends