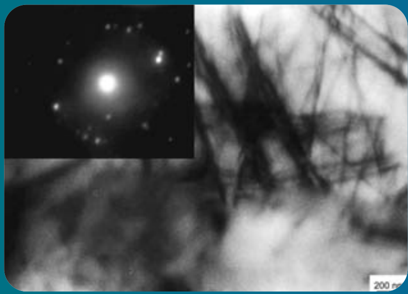
Research Monograph

Materials

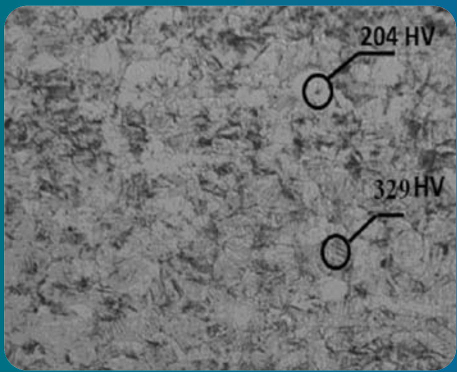
Properties

Analysis and modelling



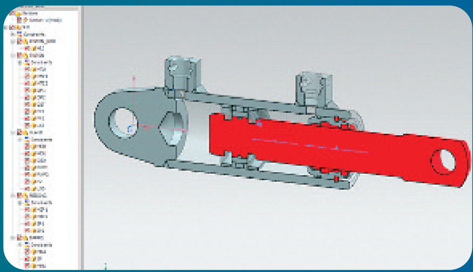
140

The research paper made by R. Babilas, S. Griner, P. Sakiewicz and R. Nowosielski on "Structure, thermal and magnetic properties of $(Fe_{72}B_{20}Si_4Nb_4)_{100-x}Y_x$ (x = 0.3) metallic glasses" on a **page 140** describes the structure characterisation, thermal and soft magnetic properties analysis of selected Fe-based metallic glasses in as-cast state and after crystallisation process. The XRD and TEM investigations confirmed that the studied alloys $Fe_{72}B_{20}Si_4Nb_4$ and $Fe_{70}B_{19}Si_4Nb_4Y_3$ were amorphous in as-cast state. The liquidus temperature assumed as the end temperature of the melting isotherm on the DTA reached a value of 1550 K and 1560 K for $Fe_{72}B_{20}Si_4Nb_4$ and $Fe_{70}B_{19}Si_4Nb_4Y_3$ alloy, adequately. The analysis of crystallization process indicated that onset and peak crystallization temperature increased with increasing of heating rate at DSC measurements. The samples of $Fe_{72}B_{20}Si_4Nb_4$ alloy presented two stage crystallisation process. The initial magnetic permeability of examined samples increased together with the increase of annealing temperature and reached a distinct maximum at 773 K for $Fe_{72}B_{20}Si_4Nb_4$ and at 723 K for $Fe_{70}B_{19}Si_4Nb_4Y_3$ alloy. The studies were performed on $Fe_{72}B_{20}Si_4Nb_4$ and $Fe_{70}B_{19}Si_4Nb_4Y_3$ metallic glasses in form of ribbon. The amorphous structure of tested samples was examined by X-ray diffraction (XRD) and transmission electron microscopy (TEM) methods. The crystallisation behaviour of the studied alloys was examined by differential thermal analysis (DTA) and differential scanning calorimetry (DSC). The soft magnetic properties examination of tested materials contained initial magnetic permeability and magnetic permeability relaxation measurements. The applied investigation methods are suitable to determine the changes of structure and selected properties between studied alloys, especially in aspect of the soft magnetic properties improvement after annealing process.



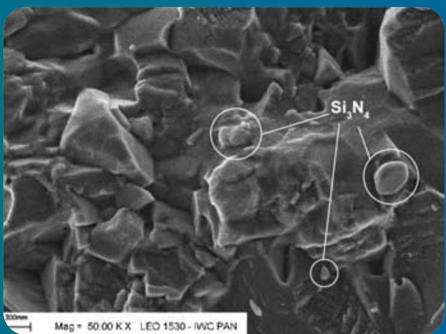
148

The Materials section represented by A. Kurc-Lisiecka and E. Kalinowska-Ozgowicz in "Structure and mechanical properties of austenitic steel after cold rolling" on a **page 148** determines the influence of the cold plastic deformation within the range 18÷79% and heat treatment in a temperature range of 500 to 700°C on the microstructure and mechanical properties of austenitic stainless steel grade X5CrNi18-8. The investigations included observations of the microstructure on a light microscope, researches of mechanical properties in a static tensile test and hardness measurements made by Vickers's method. The analysis of the phase composition was carried out on the basis of X-ray researches. Whereas, X-ray quantitative phase analysis was carried out by the Averbach Cohen method. Two-phase structure $\alpha' + \gamma$ of austenitic Cr-Ni steel in deformed state working at elevated temperature undergo a transformation. It significantly influences mechanical properties of steel. Austenite phase undergoes recrystallisation, while martensite α' phase undergoes reverse transformation. Heat treatment of X5CrNi18-8 stainless steel in the range 500÷700°C causes significant decrease of the mechanical properties (R_m, $R_{p0.2}$) and increase of elongation (A). Hardness of investigated steel drops with decrease of cold working degree and increase of heat treatment temperature.



187

The paper entitled "Disassembly and aggregation in computer aided overhaul preparation" by W. Janik and P. Gendarz on a **page 187** informs about disassembly and aggregation procedures which are main aspects of an overhaul process. The paper presents the example of an application that solves automation of technical mean recirculation procedures. Automation in the aspect of overhaul process preparation should be obtained through new tools specially oriented to refurbish mechanically used or damaged components. CAO is an original and a new approach that should be considered especially in heavy industry. Nowadays subjective decisions about how to refurbish in overhaul processes could be replaced by automated computer aided solutions. Positive economic impact to future and present overhaul processes execution in industry. A method of technical mean refurbishing with computer aid application. A proposition of automation in aspects of: disassembly (disassembly correct sequence) and aggregation procedures (which elements should be examined). Nowadays overhaul processes are based directly in most cases on leading technologist experience. An elaborated method and application leads to more objective solutions (decisions) based on algorithms results.



198

In the paper entitled "Cubic boron nitride based composites for cutting applications" by P. Klimczyk, P. Figiel, I. Petrusha and A. Olszyna on a **page 198** the results of experiment, which made it possible to obtain durable fined-grained cBN-Si_3N_4 composite with high values of hardness and fracture toughness, and can be successfully used as a cutting tool are presented. Authors employed two variants of the cBN-Si_3N_4 composites („I" – with micropowder cBN and „II" – with mixture of micro- and nanopowdes cBN) contained 3% of nanodispersed Si_3N_4 powder, sintered at High Pressure – High Temperature (HPHT) conditions. Little quantity of the Si_3N_4 nanopowder fills up the porous between cBN grains thus result in resistance to crack propagation by means so called "crack deflection" mechanism. A set of physical-mechanical properties, phase composition and microstructure of sintered materials are discussed in the paper. The comparison of the mechanical properties of cBN-Si_3N_4 (I) and cBN-Si_3N_4 (II) composites showed that the addition of 10% cBN nanopowder to mixture caused small increase in hardness from 4750 up to 4855 HV10 and decrease in Young's modulus from 842 to 812 GPa. Fracture toughness of both type of composites is on the same level above 10 MPa·$m^{1/2}$. The obtained material is characterized by favourable combination of hardness and fracture toughness required in different machining operations, e.g. in interrupted hard cutting but Authors pointed that high hardness of cBN-Si_3N_4 composites present a technical challenge in shaping them. A commercial application of presented materials, e.g. cutting tools production, needs to develop a high efficient cutting, lapping and grinding techniques.

Manufacturing and processing

Education and research trends