SUMMARIES

Siwek A.:

Laser Melted Steel Free Surface Formation

Metallurgy and Foundry Engineering – Vol. 33, 2007, No. 1, pp. 13÷21

Two-dimensional mathematical model of recasting steel by laser was presented in this paper. Surface velocity and liquid temperature for several powers of laser beams and sulfur contents were obtained as results of numerical modeling of liquid flow and heat exchange processes. The shape of free surface in a melted zone was computed with the use of iterative method proposed in this paper.

Keywords: *laser treatment, simulation, numerical analysis, Marangoni effect, convection, geometry of the melted zone*

Wojtaszek M., Durak J.:

The Application of Fuzzy Logic Analysis to Assessing the Significance of Mixing Parameters for the PM Metal-Ceramic Composite

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An attempt to implement the fuzzy logic to quick and economic analysis of the mixing process in two component system (alumina powder-ceramic fibres) was made. An experiment with composites made by the powder metallurgy method and the determination of its selected properties were carried out. To obtain samples cold moulding and coextrusion were used. The forming process was made with constant parameters of mixing and forming. The influence of fibre volume fraction in the matrix on the selected properties and the microstructure of the product was investigated. Experimental results and experts' knowledge were the input information for numerical computations and were represented by linguistic variables, fuzzy sets and fuzzy rules. Obtained or estimated in such way information from the technical point of view must be treated as an incomplete and uncertain knowledge. It means the mathematical description verified by experiments is not available. This knowledge was used to analyse the mixing parameters by the fuzzy logic. To implement inference the Fuzzy Logic Toolbox from Matlab package was used.

Keywords: *powder metallurgy, metal-ceramics composite, mixing, fuzzy logic*

Matusiewicz P., Czarski A., Adrian H.:

Estimation of Materials Microstructure Parameters Using Computer Program SigmaScan Pro

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Possibilities of SigmaScan Pro computer program applications in quantitative characterization of materials microstructure are described in this paper. The studies were carried out for microstructures

of different types, i.e. granular single phase, dispersed and lamellar. Furthermore possibilities of shape factors utilization in quantitative studies of microstructure, particularly in range of microstructure stability are presented in details.

Keywords: *image analysis, SigmaScan Pro, stereology, shape factors*

Czarski A., Skowronek T., Osuch W.:

Influence of Orientation Relationship between Ferrite and Cementite in Perlite on Stability of Cementite Plates

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The aim of the studies performed was to assess an influence of crystallographic orientation relationship (OR) between pearlitic ferrite and cementite on a stability of cementite plates. Diffraction analysis made with an electron microscope showed the existence of the Bagaryatski OR and the Pitsch OR both in the pearlite structure after eutectoid transformation and after each tested time of the spheroidization annealing. The obtained results indicate that the crystallographic orientation relationship does not influence the stability of cementite showing lamellar morphology.

Keywords: *pearlite, spheroidization, crystallographic orientation relationship*

Kajtoch J.:

Strain in the Upsetting Process

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In the paper strain distribution in materials commonly referred to as soft materials (electrolytic copper 99,9 % Cu, annealed) and hard ones (steel 20, containing 0,2 % C) produced during hot upsetting process. Numerical calculations were performed with a use of commercial software QForm2D/3D. Significance of the influence of friction forces in the head surface on the free surface profile and distortion of rectangular coordination grid of deformations, as well as, effective strain distribution, in various stages of the process was investigated. The results indicate changes in nonuniformity of strain in obtained forgings.

Keywords: *upsetting, strain nonuniformity, rectangular grid distortion, effective strain distribution*

Wojtaszek M.:

Properties of Aluminium-Ceramic Phase Composites Produced from P/M Compacts in Hot Forging and Extrusion Processes

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The results of investigations of properties of aluminium-based composites produced by means of powder metallurgy and plastic working processes are presented in the paper. Atomized aluminium powder was used as a metallic matrix. As a reinforcement ceramic particles and fibres were used, and their volume fraction was maintained constant at 5%. The initial material to be formed was prepared by

mixing of ingredients and compaction of the obtained mixture. Aluminium powder compacts and composite mixtures were subjected to consolidation and deformation in closed-die hot forging and hot extrusion processes, applying the extrusion ratio $\lambda = 4.11$. These processes were realized in isothermal conditions, at the temperature of 500°C. The effect of a type of reinforcing phase as well as method of deformation on selected physical, mechanical and functional properties of obtained materials was analysed. It was found that the proposed method results in obtaining highly compacted products, showing mechanical and functional properties which allow to use them in structural components. The product properties can be controlled by means of selection of a type of reinforcing phase as well as method of deformation.

Keywords: *powder metallurgy, aluminium powder, composites, ceramic particles, ceramic fibres, hot forging, hot extrusion, physical properties, mechanical properties, abrasive wear*