

SUMMARIES

Chyła P., Łukaszek-Solek A., Sińczak J.:

Strain Distribution in Cogging Process of Ingots with Internal Discontinuities

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In this paper is presented analysis of cogging process of the 16 Mg ingot in the three-dimensional state of deformation, using commercial program QForm 3D to evaluate effective strain distribution. Additionally voids closing were analysed, which were purposely inserted (various diameters and shapes) in selected areas. Numerical calculations were carried out for two following processes: upsetting of the reformed ingot and cogging process. Cogging operation of reformed material was simulated according to two schedules from the head and the bottom side of the ingot. As a criterion of valuation of the cogging process with flat dies were accepted maps of effective strain distribution.

Keywords: effective strain distribution, cogging process, numerical calculations

Krawczyk J., Pacyna J.:

Effect of the Cooling Rate on the Mottled Cast Iron Microstructure Designed for the Mill Rolls

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The influence of the cooling rate changes on the mottled cast iron microstructure was described in the paper. The investigated material constituted mottled cast iron, spheroidal, chromium-nickel. This cast iron, according to currently binding standards was marked GJS-HV300(SiCrNi2-3). The microstructure was described both qualitatively and quantitatively. The discussion of the formation mechanisms and their influence on the morphology of structural components and phases was conducted. The heat treatment was performed in such a way as to obtain either a pearlitic or a bainitic matrix as well as a different morphology of ledeburitic cementite and graphite precipitates for the same matrix.

Keywords: mottled cast iron, ledeburitic cementite, graphite, pearlite, bainite, heat treatment

Czarski A.:

Assessment of a Long-Term and Short-Term Process Capability in the Approach of Analysis of Variance (ANOVA)

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One of the fundamental tasks of the Statistical Process Control (SPC) is the assessment of capability of a process relating to client's expectations. Relating to a client, all process capability indices are, first of all, information on technological potential of a process, so they can be a criterion respecting

selection of a producer. Relating to a producer, the indices can be a proof for process improvement or an alarm signal regarding a process performance. In the industrial practice long-term and short-term capability indices are determined very often (marked adequately as Pp, Ppk and Cp, Cpk). This method enables a detailed analysis of the process performance relating to a variability. The point is, first of all, to identify a presence of a so-called variability dependent on time caused e.g. by changes in a lot of raw material, successive process settings, a service of different operators etc. In other words we are interested if a process position for the sake of an analyzed parameter undergoes statistically significant variations in time.

The study is mainly of a methodological character. There is a deepened interpretation of indices of a long-term and short-term process capability based on a one-way analysis of variance (ANOVA) presented. The performed considerations are illustrated with a computational example based on data concerning heat treatment of drop forgings. The better, more complete understanding the method of the assessment of a long-term and short-term process capability should facilitate the Users a correct interpretation of results and enable to avoid mistakes connected with possible not meeting the method assumptions necessary for use.

Keywords: *statistical process control (SPC), long-term capability, short-term capability, analysis of variance (ANOVA)*

Pawłowski B., Bała P., Krawczyk J.:

Some Factors Influencing the Determination of Eutectoid Transformation Start and Finish Temperatures in Hypoeutectoid Steels

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This paper presents presents problems related to the proper determination of the eutectoid transformation start and finish temperatures in steels during heating. Information from references indicate an essential influence of interlamellar spacing in pearlite on the formation of the dilatation effect related to the eutectoid transformation finish, on dilatometric curves. It was revealed, in this paper, that the appearance of the dilatation effect related to the eutectoid transformation finish in hypoeutectoid steels or its lack in the heating dilatograms depends on the resolution ability of the applied dilatometer.

Keywords: *pearlitic transformation, dilatometric examinations, phase transformation temperatures, interlamellar spacing, hypoeutectoid steel*

Czarski A.:

Simulation of Dispersed Microstructure

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Stereological description of dispersed microstructure is not an easy problem and is constantly a subject of research [1, 2]. From the practical point of view, the stereological description of this type of microstructures is essential in analyses of such processes as coarsening, spheroidization or in research of relationship between the microstructure and mechanical properties (e.g. bearing steel). The method of computer simulation is a very comfortable and effective way to test properties of stereological parameters of a microstructure. The computer model of a dispersed microstructure presented in the

work is based on the following assumptions: (1) particles of dispersed phase are spheres randomly distributed in space; the input data are: number of spheres in unit volume N_v , volume fraction of spheres V_v and distribution of sphere diameters in space (through the probability density function $f(D)$), (2) the system of spheres is being cut by the cutting planes. As a result of the simulation we obtain the distributions of flat sections' diameters.

The correctness of the model performance has been verified considering two cases relating to which we know analytical relations between distribution of spheres in space and distributions of flat sections' diameters: (1) the simulated structure consists of spheres of equal size, (2) spheres are subject to the Rayleigh distribution.

Keywords: *dispersed microstructure, simulation, stereology, random number generation*

Karczewski K.:

Application of Water Equivalents Method to Calculation of Ceramic Heat Exchangers

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Application of water equivalents method to calculation of ceramic heat exchangers are presented. By water equivalents method, mathematic model and algorithm of calculation the recuperators made of magnesia shapes were elaborated. By the model, ceramic recuperator to glass melting tank were calculated.

Keywords: *ceramic recuperator, water equivalent, shape, glass melting tank, the number of heat transfer units*

Kmita A., Janas A., Hutera B.:

Synthesis and Evaluation of the Structure of Ni₃Al/C Alloy

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The article specifies a method used for the manufacture of a new Ni-Al-C alloy with the description of alloy microstructure. When proper conditions are maintained, the said alloy after solidification forms a natural "in situ" Ni₃Al/C composite. Particular attention was paid to the process of synthesis of Ni₃Al phase by the technique of cost-effective melting and to the process of the formation of different graphite forms after the solidification in ceramic mould of casting characterised by different wall cross-sections, and hence by different heat transfer rates. Metallographic examinations were carried out by the commonly used techniques and by scanning electron microscopy. The use of the latter enabled the determination of the chemical composition of phases formed during casting process. The aim of the present studies was to evaluate the microstructure of this unique alloy. The phase morphologies were examined and their chemical composition was determined. These fundamental studies should enable the determination of conditions under which the graphite eutectic is formed in Ni-Al alloy and, as a consequence, the synthesis of Ni₃Al/C composite.

Keywords: *aluminide, nickel aluminide, intermetallic phase, "in situ" composite, natural composite*