

## SUMMARIES

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Kawalec M., Fraś E.:

### **Forming of the Microstructure in Fe-C-V Alloys**

Metallurgy and Foundry Engineering – Vol. 37, 2011, No. 1, pp. 17÷24

The study presents the results of microstructural examinations of the volume solidifying Fe-C-V alloys containing carbon in the range of 1.45÷2.23% and vanadium in the range of 7.33÷15.08%. Attention was focussed on near-eutectic alloys. The Fe-C-V eutectic crystallising in these alloys is composed of ferrite and vanadium carbides of VC<sub>1-x</sub> type, and as such is included in the group of fibrous eutectics.

During research, the experimental eutectic lines were plotted for Fe-C-V alloys, and a formula enabling calculation of the eutectic saturation ratio of these alloys was proposed.

*Keywords:* Fe-C-V alloys; eutectic; high-vanadium cast iron, microstructure

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Muskafa K., Nadolski M., Derda A.:

### **Decorative Layers on Silicon Bronzes**

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Decorative coatings artificially obtained on the surfaces of copper castings, commonly called artificial patinas in opposition to natural patinas, allow for adjusting the colour, the gloss, and the colour intensity of a casting to the customer demands. A decorative coating is a part of the artistic casting and the key element to the impression exerted by a sculpture. The colour, the type, and quality of a decorative coating depend on the author's intention, so that an artistic foundry should deal successfully with a variety of demands. Beside exerting the strictly artistic impression, patinas have one more goal to achieve – it is the corrosion protection. Natural patinas arising nowadays are characterised by low quality, irregular thickness, numerous cracks, and the dull taupe-brown colour. Therefore there exists need of generating decorative coatings in a controlled way. The present work is aimed to determine the influence of mechanical abrasive working applied to the surfaces of BK331 silicon bronze castings on the quality and durability of the obtained decorative coating for given recipes for patinating solutions.

*Keywords:* decorative layers, bronzes, protective coatings, patinas

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Major-Gabryś K., Dobosz S.M.:

### **The Influence of the Glassex Additive on Technological and Knock-out Properties of the Moulding Sands with Hydrated Sodium Silicate and New Ester Hardeners**

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The article takes into consideration the researches concerning inserting the Glassex additive to the moulding sands with water glass and the new ester hardeners. The investigations combine the works

connected to the Glassex additive influence on the moulding sand's with water glass knock-out properties and the works connected to the elaboration of the new ester hardeners upgrading of ability to mechanical reclamation of the moulding sand with water glass.

*Keywords: self-hardening moulding sand, water glass, knock-out properties*

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Zych J., Snopkiewicz T.:

### **Drying and Hardening of Ceramic Moulds Applied in the Investment Casting Technology – Investigations of the Process Kinetics**

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Ceramic moulds applied in the investment casting technology are multilayer structures, built in an alternating process of depositing and drying of successive layers. Each individual layer is formed from a fluid (liquid) ceramic moulding sand and a grain matrix. In the current, environmentally technology fluid ceramic sands based on ethyl silicate are being substituted by ceramic sands containing colloidal silica as a binder. The ability and rates of drying and hardening of these new colloidal (water) ceramic moulding sands are quite different than of the ones which have a binder dissolved in alcohol. The kinetics of the process based on new binders is not well known. The technological principle requires that the successive layer deposition is done only when the one deposited previously is already sufficiently dry.

Investigations of the possibility of application of some methods including: ultrasound, resistance and weigh method are presented in the paper. Advantages and disadvantages of each method is indicated as well as the assessment of their practical suitability is performed.

*Keywords: investment technology, ceramic moulds, ultrasonic technique, hardening kinetics*

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Kamińska J., Kolczyk J., Żymankowska-Kumon S.:

### **Dependence of Tensile Wet Strength from Regeneration Time and Grain Size of the Matrix Ceramic Moulds**

Metallurgy and Foundry Engineering – Vol. 37, 2011 No. 1, pp. 53÷61

Production technology of investment casting involves transmitting the elements of shape, dimensions and properties by filling in the appropriate liquid metal ceramic forms reproduced by a model made of wax removed by melting it. The manufacturing process of investment casting in the lost wax technology consists of a number of technological operations: preparing of wax models and their assembling in the model units, the preparation of ceramic mixture, successive layers of debris, wax melting in an autoclave, drying the samples at 100 °C, heating the samples at temperatures ranging from 400 to 700 °C. So far, the technology was based on the use of ceramic mixture, which the bond was hydrolysed ethyl silicate. Currently, due to environmental protection and improvement of working conditions, more and more binders with alcohol is replaced with an aqueous solution of colloidal silica.

In the study, to create the individual layers a ceramic form, used regenerated ceramic mixture derived from foundry and green ingredients. The regeneration time was respectively 5 and 15 minutes.

Used ceramic moulds after mechanical reclamation was given to sieve analysis to determine the grain size ( $d_L$ ). Grain sizes 0.2, 0.4 and 0.63 mm were used for the coating of ceramic moulds. The paper presents results of research aimed at the determination of the relationship between tensile wet strength and grain size of ceramic mould:  $R_m = f(d_L)$ . Tests were conducted on cylindrical samples, which deposited the layers of reclaimed ceramic material.

**Keywords:** *foundry, ceramic mould, matrix, temperature*

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Derda A., Nadolski M., Muskała K.:

### **Lifecasting in Artistic Casting**

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The paper presents a study of the artistic casting production process starting from a living model. An attempt has been undertaken to develop a technology of creating a copy of human face and head using the materials applied in dental prosthetic. The development of a copying technique for human face and head has been preceded by preparing copies of simpler elements, namely hands and feet. The scope of investigation has included a modification of alginate impression material for the purpose of copying in accordance to the lifecasting method, preparation of an alginate-plaster mould from a living model, then making the plaster replica of the model and secondary silicone-plaster mould. The castings presented in the paper have been finally made of CuSn5Zn5Pb5 tin-zinc-lead bronze by investment casting method. The performed investigative and artistic work has confirmed the suitability of the 'Tropicalgin' material for making a replica of human face according to the lifecasting method. The obtained castings exhibit excellent surface quality despite multiply copying operations.

**Keywords:** *lifecasting, artistic casting, alginate material*

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Grabowska B., Holtzer M., Kot I., Kwaśniewska-Królikowska D.:

### **Spectrophotometry Application for the Montmorillonite Content Determination in Moulding Sands with Bentonite**

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The theoretical bases of spectrophotometry used in analysis are discussed in the paper as well as the results of investigations of the montmorillonite content by means of the spectrophotometric adsorption of the Cu(II)-triethylenetetramine (Cu-TET) complex are presented. Bentonites originated from various producers (Süd Chemie, ZGM Zębiec S.A.) as well as samples of model moulding sands bonded by these bentonites were investigated in respect of their montmorillonite content. The montmorillonite content was measured in samples being at a room temperature and at temperatures of 400 °C and 700 °C. It was indicated, that the determined montmorillonite content in bentonite for the bentonites under investigation and for the model moulding sands with bentonites, are comparable, which proves that the quartz matrix, does not disrupt the measuring methodology and the applied spectrophotometric method is suitable for the moulding sands. It was found that at a temperature of 700 °C montmorillonite undergoes deactivation in the tested bentonites.

**Keywords:** *montmorillonite, moulding sands with bentonite, rebounding, spectrophotometry, adsorption of Cu(II)-triethylenetetramine complex*

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Kamińska J., Dańko J.:

**Analysis of the Granulation Process Mechanism – Stand and Scope of Experimental Investigations**

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The paper presents the basic issues related with the post-reclamation dust management by using the technique of agglomeration by granulation. Post reclamation dust derives from different types of molding sands and has different susceptibility for granulation process.

Theoretical aspects of granulation are discussed along with the mechanism of this process presented in current literature. Additionally paper describes the experimental test stand for granulation the post reclamation dust and the scope of planned scientific research.

*Keywords: environmental protection, reclamation process, granulation process*

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Maj M.:

**Allowable Strain as an Indicator of Fatigue Life**

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Fatigue life, allowable strain and different data on the fatigue resistance of metals and alloys are of great importance for the designer. Knowledge of this subject is very important, given the complicated nature of its impact on many factors, starting with the specific properties of different alloys and in the conditions of their operation ending. This is the reason why, in many cases, the aforementioned complex nature of the effect may remain unknown, which can result in too high values of the safety factors adopted in calculations and, consequently, in excessive enlargement of the weight of individual parts of the machinery and equipment, especially as regards the cast elements.

In this publication to evaluate the effort (fatigue life), the equivalent strain calculated by the aforementioned method directly from the results of the strain measurements was compared with the permissible strain limit, determined from the results of an MLCF fatigue test. Detailed analysis of the obtained results enables us to claim that permissible strain limit can be regarded as an indicator of the fatigue life.

*Keywords: mechanical properties, permissible strain limit, fatigue limit, oligocyclic test*

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Burbelko A., Początek J.:

**Reduction of the Calculation Time in the Modeling of the Microstructure Formation by CAFD Method**

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In the CAFD solidification modeling (Cellular Automaton + Finite Difference) as the growing grains shape, as the final microstructure of the alloy were not superimposed beforehand but were obtained in the simulation. CAFD models take into account heat transfer, components diffusion in the solid and liquid phases, nucleation kinetics, solid border migration and liquid phase vanishing etc.

Computer methods that include the solutions for all above mentioned phenomena are very time-consuming. The “bottleneck” of the models is the temperature field calculation. Acceleration of the well-known Gauss-Seidel (GS) iterative method of the numerical solution of the difference equations set was proposed by mean the selective reduction of the iteration number for the different equations used in the temperature field modeling.

Computer modeling results obtained by the known GS method and results of the proposed reduced scheme using were compared with the known analytical solution of the Schwarz task. It was shown that the reducing of the solution tolerance results in the substantial increase of the solution time but has a small influence on the mean quadrate deviation between the numerical results and the analytical one. Proposed solution scheme results in the significant reduction of the calculation quantity and the simulation time.

**Keywords:** *solidification modeling, cellular automaton, reduction of the calculation time*