SUMMARIES

Fraś E., Górny M., Lopez H.F.:

Solidification Conditions of Gray and White Cast Iron. Part I – Theoretical Background

Metallurgy and Foundry Engineering – Vol. 31, 2005, No. 1, pp. 13÷35.

The present work is based on a heat balance during the solidification of cast iron. Accordingly, an analytical expression was derived to relate the chilling tendency (CT) of cast iron with nucleation and growth processes associated with eutectic graphite and cementite constituents. A relationship is found between the CT and factors such as the physical-chemical state of liquid, the distribution of nucleation sites, and the density of nucleation sites for eutectic grains. In particular, it is found that the casting modulus (M), enabling determinations of minimum wall thickness for chilled castings or chill widths in wedge shaped castings can be related to the CT. Finally, the present work provides a rationalization for the effect of technological factors such as the chemistry of the melt, inoculation practice, holding temperature and time on the resultant CT and chill of the cast iron.

Keywords: *chill, chilling tendency, graphite eutectic, cementite eutectic, cast iron.*

Fraś E., Górny M., Lopez H.F.:

Solidification Conditions of Gray and White Cast Iron. Part II – Experimental Verification

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In this work, an experimental verification of the theoretical principles for the transition from gray to mottled and white cast iron solidification is presented. Experimental tests have been implemented using plate and wedge shaped castings of various sizes. The experiments included inoculated and non-inoculated cast irons of different chemical compositions and time after the inoculation treatment. In addition, thermal analysis tests were employed to determine the degree of undercooling of graphite eutectic ΔT_m. This included microstructural evaluations in order to establish the density of eutectic grain (cells). This procedure enabled the calculation of the theoretical grain density (cell count) N, the wedge value w, as well as the chilling tendency CT of cast iron. It was found that the predictions of the theoretical analysis are in good agreement with the experimental outcome for the chill exhibited in wedge and plate shaped castings.

Keywords: *chill, chilling tendency, graphite eutectic, cementite eutectic, cast iron.*

Khatemi B., Longa W.:

Determining Optimum Volume of Cold and Hot Blast Air in Single--Row Coke Cupolas

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In this study a formula was derived to calculate optimum volume of cupola blast air [$m^3/(m^2 \cdot s)$, standard operating conditions], cold or hot, for single-row coke cupolas, assuming that the lower boun-

dary of the melting zone is adhacent to the upper boundary of the combustion zone (the condition of optimum cupola running formulated by A. Achenbach in 1931). Relevant equations and tables have also been developed to make the calculations easier.

From computations made in this study it follows that the optimum blast air volume is increasing with an increase of the blast air temperature, assuming for cold blast a value close to 100 $m^3/(m^2 \cdot min)$ (Buzek postulate), with modulus of the metallic charge lumps changing in a range of 15 to 20 mm.

Keywords: *cupola, coke, blast, optimum.*

Sobula S., Głownia J.:

Oxygen-Blowing Remelts of Low-Alloyed Cr-Mn-Ni-Mo Steels with the Variable Oxidation Rate of Carbon, Chromium and Phosphorus

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Low-alloy Cr-Mn-Ni-Mo cast steels and high-alloy manganese cast steels are frequently use as castings in such areas as mineral industry and power industry. Melting technology of these steels is often based on the use the return-scrap in charge, because the prices of nickel and molybdenum are very high. Basic electric arc furnaces were used in the oxidation re-melting of high manganese and low alloyed Cr-Mn-Ni-Mo steel scraps. The measuring of bath temperature and chemical composition were realized for control of C, P and Cr oxidation rates. This article shows effect of two methods of carbon boil, used in re-melting technology: first is carbon oxydation by iron ore and second is oxygen-blowing. The results of these measurements showed that at the oxygen blowing under the pressure of ca 0,6÷0,8 MPa and oxygen capacity of 0,37÷0,60 $N \cdot m^3/(min \cdot Mg)$, the average value of decarburisation rate is 1,03÷2,08% C/h, according the temperature of the bath. In the same condition of oxidation, the dephosphorisation rate in Cr-Mn-Ni-Mo is 0÷0,12% P/h. It was shown that the temperatures above 1620°C protected steel bath against high chromium losses. At these temperatures the average value of phosphor oxidation rate is 0,070% P/hour.

Keywords: *remelting process, oxidation of phosphorus, oxygen blowing, low alloyed steels.*

Iwanciw J., Kalicka Z., Kawecka-Cebula E., Pytel K.:

Determination of the Surface Tension for Binary Ionic Solutions by Means of Butler Model

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It was attempted in this work to study the applicability of Butler approach to the metal oxide solutions. First of all, the authors tried to determine the impact of the thermodynamic activity coefficients of the components of the bulk phase on the surface tension. The activity coefficients series expansions reported by Ban-ya and one of the authors of this work were used. The model equations were solved by means of a Newton regression method, which allowed to calculate the components contents in the surface phase. Those contents were subsequently substituted into the modified Butler master equation, which gave desired final surface tensions estimates for the considered oxide binaries. The computations were done for liquid MnO-SiO_2 system (at 1843 K and 1990 K) and subsequently for MnO-Al_2O_3 (at 2058 K) and MnO-CaO (at 2473 K) systems. For MnO-SiO_2 system at 1843 K, the

obtained results could be compared to the experimental ones and a fairly good agreement was found. For MnO-Al_2O_3 and MnO-CaO systems, unfortunately, there is no experimentally measured surface tension data, therefore it was not possible to make any comparison. Nevertheless, the model may be quite useful for the surface tension estimates for the systems, which have not been yet investigated and such model calculations like presented in this work may provide acceptable predictions.

Keywords: *surface tension, Butler model, binary oxide solutions.*

Bednarek S., Sińczak J., Skubisz P.:

Modelling of Near-Net Forging of Thin-Walled Parts of Strain Rate Sensitive Alloy

Metallurgy and Foundry Engineering – Vol. 31, 2005, No. 1, pp. 87÷94.

Numerical modelling of a single-operation forging process of a radial bladed impeller forging as one piece is presented. The analysis have been performed using high-melting-alloy model material. A several alternative technologies differing in temperature and forming speed. Evaluation of the correctness of a forging process were based on distribution of effective strain, effective strain rate, mean stress as well as filling of the cavities of a die-impression in thin-walled ribs type areas.

Keywords: *isothermal forging, superplasticity, strain rate, numerical modelling.*