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COUPLED ELECTROMAGNETIC AND THERMAL PROCESSES IN THERMAL INSULATION OF INDUCTION CHANNEL FURNACES DURING CHANGES OF ITS DEFECTS CONFIGURATION

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Abstract

The interrelated electromagnetic and thermal processes that occur during induction heating of metals in channel furnaces are investigated. A mathematical model and a technique for determining the size and shape of defects (leaks of liquid metal) in the thermo-insulation material (lining) of such furnaces are developed on the basis of determination of the regularity of the time variation of the inhomogeneous temperature distribution on the surface of furnace' body. Verification of the developed mathematical model was carried out by comparing the calculated results obtained with the results of the experiment on an induction furnace for the production of high-quality copper rolled wire for the cable industry. The regions of maximum

temperatures on the furnace body and the maximum temperature gradients inside the lining are determined, as well as the dynamics of their changes on the surface of the furnace during the experiment, which lasts for more than 4.5 years. A relationship between the distribution of isotherms on the furnace body and the location, shape and depth of penetration of liquid copper into furnace thermal insulation masonry was found. On the basis of obtained relationship the hypotheses about the configuration of the currently existing defects were offered. The application of the proposed technique makes it possible to control the change in the state of the lining of induction channel furnaces and to develop recommendations for increasing their life time. References 15, figures 4, tables 2.

Key words: electromagnetic field, induction heating, temperature distribution, interrelated (multi-physical) processes, three-dimensional mathematical modeling, finite element method.

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