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MODELING AND CONTROL OF LONG-TERM ELECTROMAGNETIC AND THERMAL PROCESSES IN INDUCTION CHANNEL FURNACE FOR COPPER ROD PRODUCTION

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Abstract

The paper presents multiphysics modeling of long-term (tens of hours) electromagnetic and thermal processes with different transient times that run in induction channel furnace used in the technology of copper wire rod production. The modeling is based on the coupled nonlinear equivalent electrical and thermal circuits, taking into account such factors as the dependence of the electrical conductivity and heat capacity of heated copper gauge on temperature, the phase transition at heating to a temperature above the melting point, the periodic injection of cold

copper cathodes into the molten metal and the continuous casting of copper workpieces. As shown, the dynamic processes of heat- and mass- transfer in the furnace can be modeled by equivalent thermal circuit with nonlinear and commutated capacitances. The method is realized by Matlab/Simulink/SPS tools. The approach of artificial decrease of power supply frequency with simultaneous proportional increase of all inductances in the equivalent electrical circuit is proposed and implemented to reduce the computer time. The attained results of thermal computations give a possibility to define the rational technological conditions and parameters of the installation. References 12, figures 7.

Key words: induction channel furnace, electromagnetic processes, thermal processes, phase transition at melting of workpiece, multiphysics circuit, computer modeling.

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