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EXPERIMENTAL STUDY FOR VERIFICATION COMPUTATIONAL MODELING OF OPERATION OF THE CONDUCTIVE MHD CENTRIFUGAL PUMP

Savelii S. Katsnelson[1], Georgiy A. Pozdnyakov[2]

[1] Khristianovich Institute of Theoretical and Applied Mechanics SB RAS
Institutskaya st. 4/1, Novosibirsk,630090, Russia, savelii@itam.nsc.ru
[2] Khristianovich Institute of Theoretical and Applied Mechanics SB RAS
Institutskaya st. 4/1, Novosibirsk,630090, Russia, georg@itam.nsc.ru

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The casting process in metallurgy consists of numerous stages, including metal melting, its transportation, processing (degassing, alloying with various dopes, including nanodisperse inoculators, etc.), and finally pouring. In turn, each stage is a rather labor-consuming process with its own complicated technological chain. A common adverse factor, however, is the contact between the melt and the atmosphere. The problem could be solved by organizing a closed cycle. It should also be noted that organization of such a cycle would make this production more environmentally friendly. An important element of the cycle is the system of liquid metal supply, which should be sufficiently universal for the entire chain of out-of-furnace processing. In particular, it could include the possibility of inserting alloying dopes and nanodisperse inoculators directly into the flow with casting under a controlled pressure, which would allow obtaining cast product of an almost arbitrary degree of complexity and high quality. It is commonly accepted that a magnetohydrodynamic (MHD) system can serve as such a device [1-3]. An analysis shows that the most promising design among all possible conductive MHD pumps is the disk scheme of the centrifugal conductive pump (CCP), which has currents 1.5-2 times lower than linear schemes and allows current-carrying electrode units to be taken out from the working area.

Results obtained for a CCP model operating with a low-temperature working fluid with the main physical parameters close to those of non-ferrous metal melts are reported in this paper. The study was aimed at validating the operability of this scheme in various regimes and obtaining experimental data necessary for testing and verification of mathematical model of the CCP [4].

The fig.1 schematically shows an axial sectional view of an experimental model of a centrifugal pump. The pump consists of a housing 1 , cover 2 , the melt reservoir 3 . The reservoir is attached to the center of the cover 4 through a threaded bushing made from an insulating material. The metal sleeve 5 , which is fastened by means of a tank is a central electrode at the same time , its external diameter ranged from 10 to 16 mm. Distancing ring 6 disc sets the width of the pump . Material derived from the pump through the duct 7. The internal disc cavity of the pump S electrically insulated from the metal. Float 8 and its position detection device 9 are designed to measure the flow rate. Channels 10 are used for connection of pressure sensors for registering the distribution of static pressure in the duct of the pump . The pump is placed in a magnetic field normal to the plane of the disk channel. Current source , a feed pump , connected to the tank and the housing as shown. The pump had an ohmic heater (not shown in the diagram) , allows you to set the temperature of the melt.

Pressure was measured with a strain gauge , connected to the channels 10 via a tube filled with a special liquid is resistant to the melt.

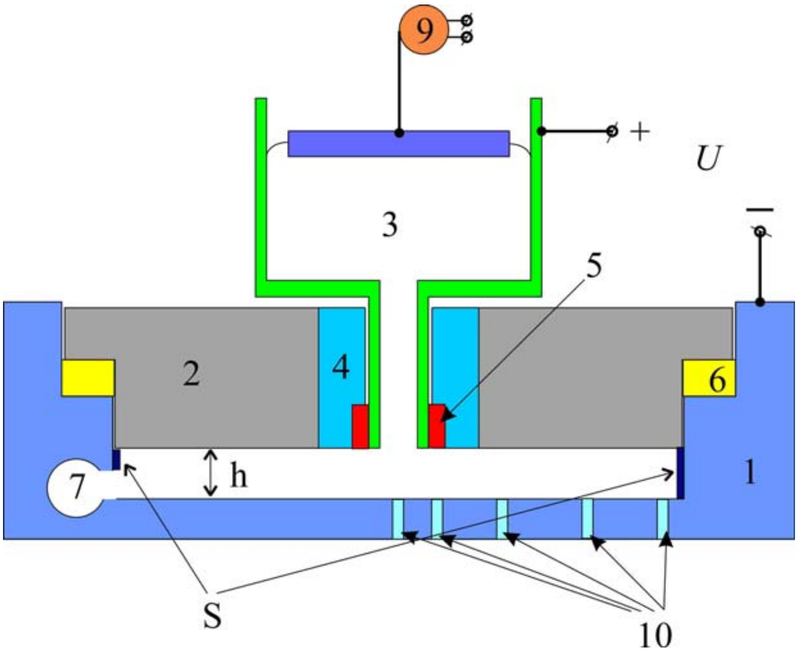

Fig.1. Cheme of experimental pump.

Use an experimental model of the pump allows measuring the flow rate depending on the pressure distribution and the full set of controlling parameters : the magnitude of the magnetic induction current through the channel , the channel height , the diameter of the center electrode , the method eleektropodvoda (by the entire cylindrical surface of the body S , or a portion thereof) . Additionally , changing the operating body (an alloy Rose , sodium , etc.) could be altered and the density of the pumped metal its conductivity .

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