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NUMERIC MODELING OF BAND'S METAL INPUT IN CRYSTALLIZER OF SLAB CCM

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There are worked out mathematical and numeral models for calculation heat- and mass-transfer of metallic bath in crystallizer of slab CCM, equipped by submersible tumbler with the sloping unloading openings. There are studied thermal and hydrodynamic conformities of melt action, including. carrying in crystallizer inoculators as a metallic band with chemical composition, different from base, with possible its oscillation.

Keywords: continuous casting of steel, slab, crystallizer, liquid metal, mathematical modeling

One of progressive methods of continuous cast is the use of different type of inoculators. Metallic materials which have similar with the cast metal composition use as inoculators. Order with the enough rare and poorly controlled methods of input of inoculators (shot, rod) the special attention deserves the use of metallic band, being by side product of production of rolled sheet.

Most defects of continuous cast blank are arises in crystallizer and determined, mainly, by character and intensity heat- and mass transfer processes. Therefore, a task of study for processes, what be going in crystallizers at a continuous cast of steel, is very actual for receipt of high-quality blank at the high productivity of CCM

The purpose of work is development mathematical and numeric models of heat- and mass transfer processes at the input of metallic blank in crystallizer of slab OOM.

At development of the model there are supposed:

– the main metal of the set chemical composition is poured out in slab blanks through one immersed bush, having two lateral unloading openings of ramous form, directed under a certain corner to the horizontal to the narrow edge of blank;

– the metallic band with chemical composition of different from a main metal is place into crystallizer along its vertical plane and in parallel wide edge on the set distance from immersed bush;

– a mirror of metal is even, without waves, and it is covered by a slag, i. e. there is not a necessity to allow the dynamics of free-form;

– from the side of crystallizer and band the border of hard metal and biphasic area is determined by the terms of heat sink to crystallizer and ribbon, and also depends on speeds of washings them metal streams.

The known stationary equations of Navie-Stokes, indissolubility of liquid metal and heat transfer are fixed in basis of mathematical model of motion and heat transfer of liquid metal in crystallizer.

«Freezing» of crust of metal there is calculated on the basis of solution of the known equation of heat conductivity Fourier in approaching of near-equilibrium biphasic area. In thermal part of calculation on the axis of symmetry model there are accepted the terms of absence of heat exchange. A radiant-convective heat exchange is set on the surface of slag. In the place of entrance of stream of metal the set temperature of overheat is accepted in crystallizer. On the surface of crystallizer set there are border terms of the first kind as sedate dependence, got by means of the statistical processing of corresponding literary data. Model adequacy was checked up by means of comparison of the got calculation values to data of physical modeling and practical experiments.

By means of the worked out models for process of continuous cast of slab blank there are investigated heat- and mass transfer processes in crystallizer at presence of immersed bush glass with the sloping unloading openings and, including., by the device for serve of inoculators' as a band and its possible oscillation. The found conformities to law of action of liquid metal allowed to define that serve of ribbon of the set thickness and chemical composition, by speed of input, oscillations and amplitudes improve the thermal and hydrodynamic state of liquid bath at the simultaneous increase of crust thickness for blank on a perimeter on an exit from crystallizer. A model can be used for any standard sire of slab crystallizer and brands of poured out steels.