

COMPARATIVE ANALYSIS OF THICKNESS PREDICTION METHODS OF HARDENED CRUST OF INGOT CONTINUOUS CASTING IN CRYSTALLIZER

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One of the most important factor that determines rational work of ingot continuous casting machine and optimum quality of a continuous casting ingot is a crystallizer where ingot forming occurs due to the at the heat reduction from melting by cooling water (from 10 % to 30 % of all heat). Knowledge of heat exchange regularity between an ingot and crystallizer allows to optimize crystallizer construction for each concrete case.

There are a lot of methods suggested for determination of layer thickness of hardened metal. In the given article the determination algorithms according to methods of Hills and Leybenzon-Veinik have been considered.

The determination of a thermal field of an ingot according to method of Hills allows to determine the thickness of hardened crust in dependence on the distance from metal level, temperature on ingot surface and heat reduction by crystallizer.

To achieve this task Lisienko V.G. and Samoylovich Y.A. considered the usage of Leybenzon-Veinik method. According to it conveying speed of boundary of separation phases depends on gradients temperature on the both sides of the boundary and field of temperatures on the thickness of hardened layer of melting.

A.I. Veinik divided the process of cast hardening in to several. Particularly, the period of direct hardening begins only after elimination of ingot hardening, that allows to simplify calculating formulas.

For studying the process of ingot crystallization in crystallizer mathematic modeling of dependence of minimally necessary thickness of the hardened slab covering at the exit of crystallizer carbon and sulfur contents in metal, temperature of metal in an intermediate scoop and slab stretching speed out of crystallizer. Has been carried out. For model operating factual thickness of layer of hardened metal under crystallizer during breaks appearly because of the cracks in the crust of normal thickness, obtained in ingot steel in conditions JSC "MMK" for slabs with section 250x1300 mm² was used.

As a result of modeling the diagrams of growth hardened crust thickness of an ingot for all mentioned above ways of determination for steel of the mark St 3sp and 08ps were obtained.

The maximal difference between meanings of hardened crust thickness in crystallizer, obtained by various means didn't exceed in a diapason of complete ingot hardening of 3 mm. This fact allows to consider sufficient reliability of obtained results of calculation.

It was proved, that while the stretching speed and overheating value increases over crystallization temperature metal hardened crust thickness decreases at the exit of crystallizer. If the value of steel overheating is low over the temperature of crystallization starting point, the whole heating has time to remove in crystallizer. To provide the proper crust thickness at the exit of crystallizer it is necessary to decrease whether ingot stretching speed out of crystallizer or metal temperature in the intermediate scoop.

Key words: ingot continuous casting crystallizer machine, thermal exchange, crystallizer, mathematic modeling.

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