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INVESTIGATION OF THE EFFECT OF SLAG CATCHER DESIGN ON SLAG DELAY EFFICIENCY IN THE SOLIDWORKS FLOW SIMULATION PARAMETRIC MODELING ENVIRONMENT

Kononchuk Serhii
Candidate of Technical Sciences
Associate Professor, Department of Materials Science and Foundry
Molokost Liudmyla
Assistant, Department of Materials Science and Foundry
Pukalov Viktor
Candidate of Technical Sciences
Associate Professor, Department of Machine Parts and Applied Mechanics
Central Ukrainian National Technical University
Kropyvnytskyi, Kirovograd region, Ukraine

Abstract: The influence of the design of the slag catcher on the efficiency of slag retention is investigated. SolidWorks Flow Simulation parametric modeling CAE module confirms the possibility of reducing the melt velocity through the use of a slag catcher with braking ribs. An original design of a ribbed slag catcher is proposed, which ensures trapping of slags and smooth filling of the mold with an alloy due to a decrease in the speed of movement of the melt without additional metal costs. It was found that the flow velocity along the cross-sectional height of the proposed ribbed slag catcher is less by 0.028 m / s or 14.5% compared to the traditional one. Using a ribbed slag catcher printed on a 3D printer, a mold was produced that showed satisfactory molding ability.

Key words: slag catcher, slag inclusion, flow rate, gating system, 3D-model, metal consumption, sand-clay mixture, mouldability

The most common technology for the manufacture of metal parts and blanks is casting. High-tech branches of mechanical engineering require the production of high-quality castings of complex configuration from modern alloys with a given chemical composition and mechanical properties.

The analysis of the causes of formation and methods of prevention in the casting of slag inclusions showed that in addition to technological means related to quality preparation of metal before pouring, a significant role is played by quiet continuous pouring of metal and properly designed foundry system, including slag catcher. However, the use of the most common casting systems (braking, throttle, with centrifugal slag catchers, rain, siphon) to increase the efficiency of slag retention is associated with increased metal consumption of the casting system, and as a consequence, increases the cost of casting [1]. Conducting experimental studies by varying the design of the slag catcher leads to an increase in the number of field experiments, given their complexity, limited by great difficulties.

On the other hand, computer flow modeling allows to study the influence of the design of the slag catcher on the flow rate of the melt in the foundries at the design stage and significantly reduce the cost of implementation in the production of new castings [2].

In order to reliably capture slag and reduce the speed of the melt in the foundries, which provides a smooth filling of the form with an alloy, but without additional metal costs, the original design of the ribbed slag catcher is proposed (Fig. 1).

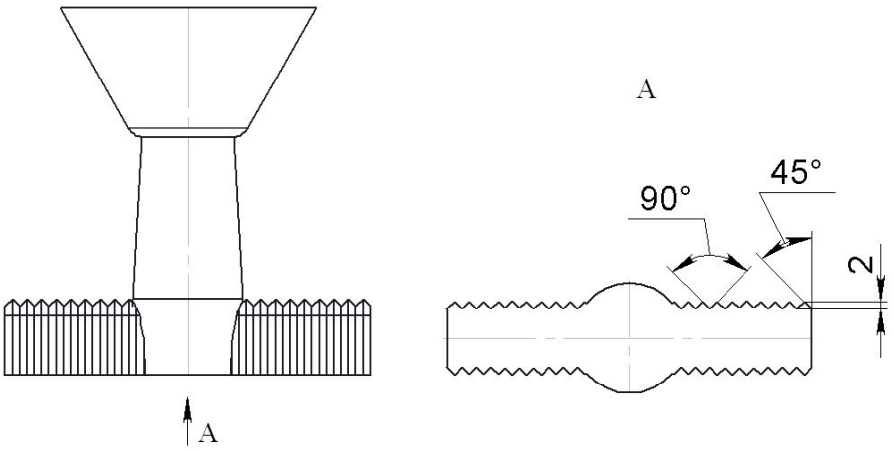

Fig. 1. Ribbed slag catcher

In the proposed design on the side and upper surfaces of the trapezoidal slag catcher with the same step applied ribs. The ribbed surface when pouring creates additional resistance to metal movement, inhibiting it. An area with a low melt velocity is formed around the walls of the slag catcher channel. The size of this area is determined by the height of the edges.

The results of computer simulation of the melt flow in the channel of the ribbed slag catcher showed a decrease in the average flow rate across the cross section of the slag catcher compared to the traditional by 0,028 m/s or 14,5 %. This allowed to reduce the length of the slag catcher to the first feeder. The expected metal savings are 0,26 %.

To test the molding ability of the proposed ribbed slag catcher was printed on a 3D printer model of the slag catcher, riser and bowl. 3D printing allows you to get three-dimensional products from computer models, allowing you to view the object and use it to prepare for production. Thus, you can see and correct possible design errors, evaluate the end result before launching the project into production [3].

The form made using a 3D model of the slag catcher showed satisfactory molding ability.

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