Optimization of the Steel Flow Through the Subentry Shroud with Inner Metering Nozzle

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The paper deals with new knowledge and experience from optimization of the steel flow through the subentry shroud with inner metering nozzle realised by physical and numerical modelling of non-stationary steel flow into a mould through the subentry shroud with an inner pressed metering nozzle. The physical and numerical modelling was realized under the conditions of the Department of Metallurgy and Foundry at VSB-Technical University of Ostrava. The special type of the subentry shroud is used during continuous casting of steel in TŘINECKÉ ŽELEZÁRNY a.s. During the continuous casting of steel, two unfavourable phenomena were observed. In the first case, it was not possible to increase the casting speed, though the diameter of the metering nozzle was extended. In the second case, the fluctuation of the casting speed among the individual casting strands was detected. These two problems did not allow an improvement of performance of the casting machine. Therefore, the physical and numerical modelling was performed. Attention was focused on the verification of the effect of the inner diameter of the nozzle body and internal diameter of metering nozzle on the resulting volume flow rates at a constant hydrostatic height above the nozzle. Four diameters of the metering nozzle: 16; 17; 17.5; 18 mm were tested. The physical modelling was done on a 1:1 model constructed from Plexiglas. The numerical modelling was realized in CFD ANSYS FLUENT software. On the base of results from the modelling study and in cooperation with VESUVIUS company, the new type of the profile of the subentry nozzle with metering nozzle was designed. The first experimental results in steel plant led to an increase in the productivity of continuous casting machine.

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