Effect of the Solidified Shell Thickness on the Impact of an Electromagnetic Brake on the Flow in the Continuous Casting Mould

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This paper presents numerical investigations with respect to the fluid flow in the continuous casting process under the influence of a ruler-type EMBR. The impact of the DC magnetic field on the outlet flow from the Submerged Entry Nozzle has been studied up to Hartmann numbers of about 400. Numerical calculations were performed by means of the software package CFX with an implemented RANS-SST turbulence model. The non-isotropic nature of the MHD turbulence was taken into account by specific modifications of the turbulence model. The numerical results were validated by flow measurements carried out in the small-scale mockup mini-LIMMCAST using the eutectic alloy GaInSn.

The electrical wall conductance ratio was identified as an important parameter, which has a serious influence on the mould flow just as it is exposed to an external magnetic field. In a real casting process the solidifying shell plays the role of a conducting wall. The wall conductance ratio increases with growing thickness of the shell. It turns out that the solidifying shell has a considerable impact on the magnetic damping of the flow. An increasing wall conductance ratio improves the efficiency of the magnetic damping effect.

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