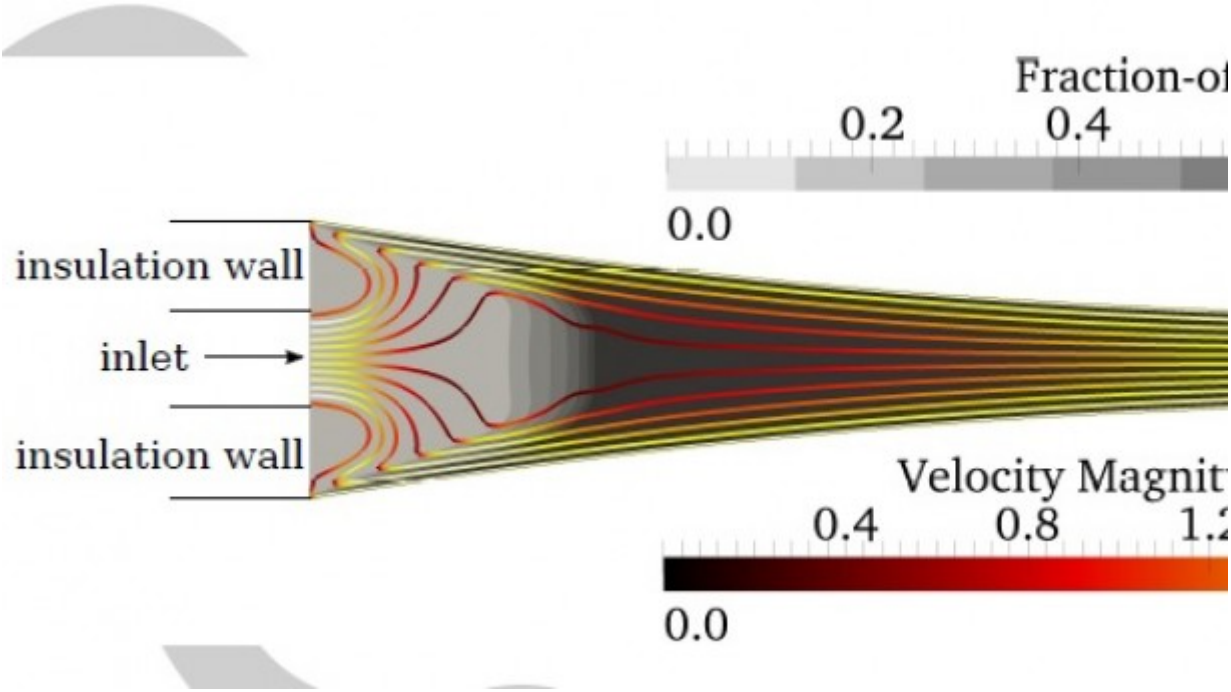
Modelling of heat transfer and solidification processes in horizontal twin-roll casting of magnesium AZ31



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Abstract:

Magnesium is a desirable material for light-weight construction due to its low density and high strength-to-weight ratio. The disadvantage of low cold formability may be overcome for sheet production by combining casting and forming within horizontal twin-roll casting (TRC). During this process, the molten alloy is fed between two counter-rotating rolls water cooled from the inside. In this paper, numerical simulations using the commercial CFD software Star-CCM+ are presented. The code provides the model based on an incompressible, steady-state solver for laminar flow. To describe the solidification, an exponential increase in viscosity for decreasing temperature is employed in addition to the fraction-of-solid approach based on a linear equation for the release of latent heat. The counter-rotating rolls are exposed to a constant heat transfer coeffcient and specify the characteristic velocity of the case. Using the full domain for the simulation of the TRC process provides asymmetric velocity profiles resulting in asymmetric temperature profiles and thus temperature differences between the two rolls. Symmetric results should not be enforced by using only half domain as the asymmetric profiles evoke recirculation zones differing in size which might infuence the solidification rate.

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