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Thermal Simulation Technology for Solidification Process of Metals

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ABSTRACT

Solidification is a common phenomenon in nature for metal preparation and thermal–physical simulation must be employed for revealing solidification mechanism. The Center for Advanced Solidification Technology (CAST) of Shanghai University focused on this topic for decades and developed various thermal–physical simulation apparatuses with regard to different solidification processes. First, a vertically horizontal-slab simulation device was developed to simulate the continuous casting solidification process, where the furnace temperature gradient, pulling velocity, pouring temperature, stretching rate, and the cooling water flux can be precisely adjusted. Second, a simulation set-up was designed for strip casting by adopting a special roller-plate structure where the information on the melt temperature, thermal stress, and linear contraction of strip can be obtained. Third, a simulation set-up for the solidification process of heavy ingot was fabricated to investigate the distribution of temperature and convection during the super-slow solidification process. Lastly, we developed a DSC-wetting angle measurement instrument to observe the interfacial wetting characteristics, and this also opens the possibility to accurately reveal heterogeneous nucleation process under external electric or magnetic fields.

KEYWORDS: thermal physical simulation, solidification, continuous casting, heavy ingot, twin roll casting, heterogeneous nucleation