CFD simulation of direct chill casting process of magnesium alloy billets

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ABSTRACT

This work demonstrates and simulates the industry scale direct chill casting of magnesium alloy (AZ31) billets processed under various conditions. The solidification mechanisms involved the conventional and melt-conditioned direct chill casting processes are simulated using the computational fluid dynamics. The heat flow and the solid-liquid interface are clearly identified for various casting speeds, depth of the rotor-stator device and the device geometry. The results also indicate that the shape and depth of the solid-liquid interface sump is sensitive to the casting parameters.

KEYWORDS

Direct-chill casting; Magnesium alloy; Solidification; CFD

REFERENCES

1. J. Grandfield, D.G. Eskin, I. Bainbridge
   Direct-chill casting of light alloys: science and technology
   John Wiley & Sons (2013)

2. D.G. Eskin
   Physical metallurgy of direct chill casting of aluminium alloys
   CRC press (2008)

3. A.R. Baserinia, H. Ng, D.C. Weckman, M.A. Wells, S.Barker, M. Gallerneault
   A simple model of the mold boundary condition in direct-chill (DC) casting of aluminum alloys
   Metall. Mater. Trans. B, 43 (4) (2012), pp. 887-901

4. L. Begum, M. Hasan
3-D CFD simulation of a vertical direct chill slab caster with a submerged nozzle and a porous filter delivery system
Int J Heat Mass Transf, 73 (2014), pp. 42-58

5. J. Sengupta, B.G. Thomas, M.A. Wells
The use of water cooling during the continuous casting of steel and aluminum alloys
Metall Mater Trans A, 36 (1) (2005), pp. 187-204