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Simulation study of Al–1Mn/Al–10Si circular clad ingots prepared by direct chill casting

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ABSTRACT

A modified direct chill casting process is based on Novelis Fusion™. Technology co-casting process was used recently to prepare Al–1Mn/Al–10Si circular clad ingots. In the current study, a comprehensive simulation model was developed to investigate the direct chill casting process for preparing the Al–1Mn/Al–10Si circular clad ingots, and a parametric study and experimental research of the direct chill casting process were conducted to explore potential success and failure casting conditions. The simulation results revealed the bonding mechanism of the Al–1Mn/Al–10Si interface in the direct chill casting process and identified the effect of certain parameters on casting performance. The results indicated that the effect of casting speed and Al–1Mn casting temperature on the variations of the minimum solid fraction of Al–1Mn at the interface is stronger than that of cooling water flow rate in inner mold, while Al–10Si casting temperature is the weakest of the four casting parameters. The corresponding experimental results verified that Al–1Mn/Al–10Si circular clad ingot with acceptable metallurgical bonding can be successfully prepared by direct chill casting process under the proper casting parameters. The thickness of diffusion zone is about 40 μm, and the fractured position in tensile test was located in the Al–1Mn alloy side, which indicated the strength of the interfacial region is higher than that of Al–1Mn alloy.

KEYWORDS: simulation study, clad ingot, direct chill casting, aluminum alloys