

Defence of a Doctoral Thesis

Problems in the Aluminium DC Casting Process Associated with Melt Treatment Operations

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Abstract

The quality of DC cast Al alloys is highly dependent on melt batch composition and impurity level in the molten alloy. The chemical composition and cleanliness of a melt is controlled through the melt treatment operations, carried out while the melt is still in the furnace before casting starts. The present work has studied some of these operations and associated problems such as slow dissolution of alloying elements, non-reproducibility in chemical composition analysis and inclusions.

The results of the dissolution of the alloy elements Mn and Fe showed different behaviors. For Mn three intermediate phases were involved, all of which exhibited a smooth interface between Mn and the liquid. These three phases were identified as the γ_2 , A_{11} , IMn_4 , and μ phases, which grow slowly towards the dissolving Mn particles. The results from the Fe dissolution revealed that only one phase dominates the process, Al_5Fe_2 , which penetrates the Fe particles with an irregular interface. The interaction between Mn and Ti additions to AA3003 alloys and consequences for the solidification and precipitation behavior was investigated. The study could map the limits for formation of an earlier unknown $AlMnTi$ phase, which formed large particles, detrimental for subsequent rolling operations.



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Date	March 25 th 2019 13:00
Place	Campus Sundsvall M102
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Welcome!