The usage of computer-aided cooling curve thermal analysis to optimise eutectic refiner and modifier in Al-Si alloys

Abstract :

Bismuth, antimony and strontium concentrations were optimised to alter the eutectic Al-Si phase in a commercial Al-Si-Cu-Mg alloy by way of computer-aided cooling curve thermal analysis. The results show that the eutectic growth temperature shifted to lower temperatures for all three inoculants. However, addition of Sr resulted in more depression of growth temperature compared with Bi and Sb. No further significant changes were observed with increasing the concentrations to more than 1, 0.5 and 0.04 wt% of Bi, Sb and Sr, respectively. The recalescence of these concentrations, meanwhile, showed a significant increase of magnitude. A good correlation was found between the results of thermal and microstructural analysis. For Bi and Sb, the eutectic depression temperature can be used as an individual criterion to gauge optimal levels of content in the refinement of Si, whereas for Sr, both depression temperature and recalescence magnitude must be considered. Based on the observed depression in eutectic growth temperature and recalescence, it can be concluded that the optimal concentrations to refine the eutectic Al-Si phase with Bi and Sb and to modify it with Sr at the given solidification conditions were 1, 0.5 and 0.04 wt%, respectively.