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Enhanced refinement and modification via self-inoculation of Si phase in a hypereutectic aluminium alloy

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Abstract

The alloy A390 was ultrasonically treated, and the resulting material was referred to as *master alloy*. The master alloy was added into a non-treated A390 melt over two different levels: 10 and 20 % by volume in order to investigate its potency for silicon refinement. Appropriate refinement of primary silicon crystals is obtained by the addition of master alloy. The addition leads to significant formation of twins and stacking faults where the former produces branching and the latter contributes to growth retard providing ~10 μ m Si primary particles. Minor eutectic Si modification is established by the Si clusters which are provided by the master alloy. By master alloy addition, roundness and aspect ratio of eutectic silicon were enhanced and the tensile properties as well as the wear resistance were improved. The morphological evolution, as well as the mechanisms involved in the primary Si refinement and eutectic modification are defined and discussed.

Keywords: Al-Si alloys; Casting; Solidification; Master alloy; Si Refinement

1. Introduction

Hypereutectic Al-Si alloys are attractive due to their appropriate mechanical properties and excellent wear defiance (Yang et al., 2009). These alloys are widely employed in the

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