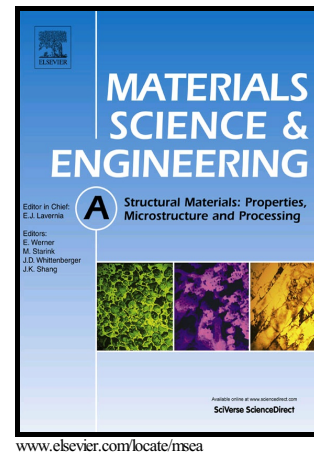


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Microstructure and mechanical properties of foundry Al-Si-Cu-Hf alloy

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Abstract

Solidification microstructure, precipitation microstructure, and mechanical properties of foundry Al-Si-Cu-Hf alloy were investigated to elucidate the role of Hf during the solidification and precipitation processes. In the as-casting condition, α -Al dendrites, eutectic Si phases, and intermetallic compounds (Al_2Cu , the needle-like β -Fe and Chinese-script α -Fe) were observed in the base alloy. However, no β -Fe was detected in the modified alloy, strongly indicating that Hf addition promotes the formation of the α -Fe phase but suppress the formation of the β -Fe phase. Furthermore, Hf addition can result not only in the formation of Hf-containing intermetallic compounds with different morphologies, which were identified as Si_2Hf , but also, more importantly, in a significant decrease in the size, number, density, and volume fraction of porosity. After treatment with solution at 520 °C for 20 h, the formation of thermally stable Si_2Hf precipitate was observed. After aging treatment at 180 °C up to 72 h, a delayed aging hardening was observed, which may be because Hf addition suppressed the formation of θ' precipitate. Clearly, Hf addition in Al-Si-Cu alloy can modify the solidification microstructure and the precipitation microstructure,

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