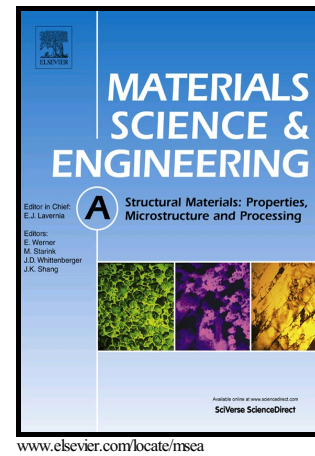


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Effect of Sc addition and T6 aging treatment on the microstructure modification and mechanical properties of A356 alloy

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Abstract

Effect of Sc addition and T6 aging treatment on the secondary dendritic arm spacing (SDAS), modification of eutectic Si morphology, β -Al₅FeSi and π -Al₈Mg₃Si₆Fe₁ phases and its effect on mechanical properties in A356 alloy has been investigated. Addition of 0.4 wt.% Sc in A356 alloy resulted in a 50% reduction in the secondary dendritic arm spacing (SDAS). Sc addition changed the morphology of eutectic Si from plate like to fibrous and globular. The needle like morphology of β -Al₅FeSi phase in A356 alloy changed to Al₅Fe(Si,Sc) phase having smaller size and irregular morphology. Transmission electron microscopy (TEM) diffraction pattern and Energy dispersive spectroscopy (EDS) analysis revealed the presence of β -Al₅FeSi and π -Al₈Mg₃Si₆Fe₁ phases in A356 alloy which changed to β -Al₅Fe(Si,Sc), π -Al₈Mg₃(Si,Sc)₆Fe₁ and additional V-AlSi₂Sc₂ phase was observed in Sc containing alloys. Addition of 0.4 wt.% Sc to A356 alloy improved its Vickers hardness, Ultimate tensile strength (UTS), Yield strength (YS) and ductility by 20%, 25%, 20% and 30% respectively. Artificial aging treatment resulted in significant improvement in the tensile properties for both A356 and Sc added A356 alloys.

Keywords: Electron microscopy; Aluminium alloys; Intermetallics; Casting; Age hardening; Phase transformation

1. Introduction

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