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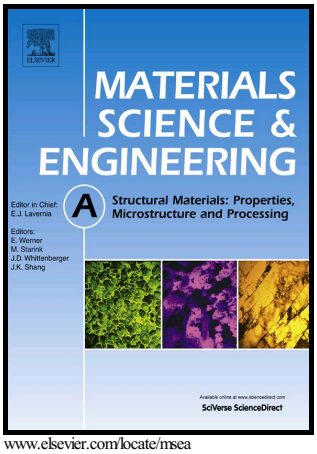

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Microstructure and mechanical properties of Al- nano/micro SiC composites produced by stir casting technique

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Abstract

In this research, composites of A356- nano SiC (0.5 and 1.5 wt.%) and A356-5 wt.% of micro SiC were produced by stir casting technique. After applying T6 heat treatment on a part of cast ingots, all samples were studied by optical and SEM microscopy and mechanical testing techniques. It was found that adding SiC particles decreases dendrite lengths because the particles act as the preferential nucleation sites for the solidification of matrix. The best modifying effect was observed in the composite containing micro SiC particles. The T6 heat treatment on A356 resulted in the dissociation and globularization of Si platelikes and formation of complex AlMg SiFe intermetallics and nano-sized Mg_2Si particles. The mechanical strength of A356 increased considerably by combining T6 heat treatment and adding micro/nano SiC particles. The highest strength was obtained in the composite containing 1.5 wt.% nano SiC. The SEM observations showed that fracture in cast A356 occurs along the dendrite boundaries. However, the T6 treated alloy showed a combined interdendritic and cleavage fracture. The same combined mode of fracture was observed for the alloy with 0.5 wt. % nano SiC. The brittle fracture in the composites was attributed to the existence of SiC and/or intermetallic compounds in the matrix. The fracture mode for other composites was fully cleavage.

Keywords: Stir Casting; Compocasting; Heat treatment; Nanocomposite; Strength; Tensile test.

1- Introduction

Nowadays, metal matrix composites (MMCs) are widely used for different industrial applications [1, 2]. They are suitable materials which combine the advantages of metals and ceramics. Ceramic materials like Al_2O_3, SiC, TiO_2 and clay are often added to the