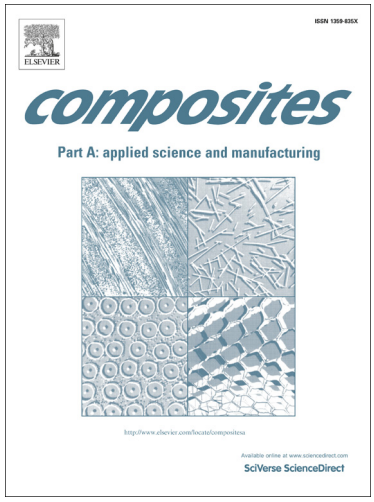

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Enhanced tensile properties of aluminium matrix composites reinforced with graphene encapsulated SiC nanoparticles

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Abstract

Due to a high propensity of nano-particles to agglomerate, making aluminium matrix composites with a uniform dispersion of the nano-particles using liquid routes is an exceptionally difficult task. In this study, an innovative approach was utilised to prevent agglomeration of nano-particle by encapsulating SiC nano-particles using graphene sheets during ball milling. Subsequently, the milled mixture was incorporated into A356 molten alloy using non-contact ultrasonic vibration method. Two different shapes for graphene sheets were characterised using HRTEM, including onion-like shells encapsulating SiC particles and disk-shaped graphene nanosheets. This resulted in 45% and 84% improvement in yield strength and tensile ductility, respectively. The former was ascribed to the Orowan strengthening mechanism, while the latter is due primarily to the fiber pull-out mechanism, brought about by the alteration of the solidification mechanism from particle pushing to particle engulfment during solidification as a consequence of high thermal conductive graphene sheets encapsulating SiC particles.

Keywords: Metal-matrix composites (MMCs) (A); Graphene sheets (A); Mechanical properties (B); Casting (E)

1. Introduction

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