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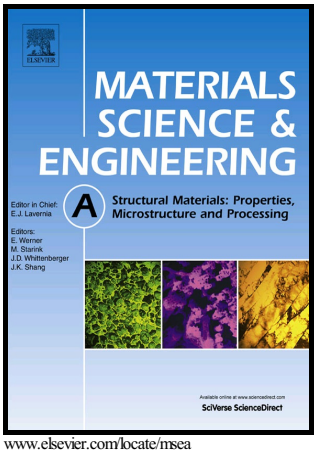

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Fabrication of $Mg/Al_{12}Mg_{17}$ in-situ surface nanocomposite via friction stir processing

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ABSTRACT

In this study, in-situ magnesium matrix surface nanocomposites were prepared by adding Al particles to an as-cast pure Mg ingot using friction stir processing (FSP). The effects of the number of FSP passes, tool design, rotational and travel speeds were investigated. Microstructural investigations showed a significant grain refinement owing to dynamic recrystallization. According to scanning electron microscopy examinations and X-ray diffraction results, $Al_{12}Mg_{17}$ intermetallics were formed during FSP due to chemical reaction at the Al-Mg interface. As a result of severe plastic deformation, the intermetallic particles formed at nanometre size. X-ray diffraction showed that the crystalline size of intermetallic particles reached ≤50 nm, due to high material flow during FSP. The intermetallic formation and grain refining led to an increase in the hardness values (1.5 to 3 times) that of the as-cast pure Mg ingot.

Keywords: Magnesium; Metal Matrix Composites; Intermetallics;

1. Introduction

The low specific gravity, high specific strength, and high recyclability of Mg based alloys make them very attractive for aerospace, automotive and industrial devices [1, 2]. However, the mechanical properties of Mg alloys are not adequate to improve their application. For this reason, in recent years there has been large number of studies on the fabrication of ceramic particle/Mg alloy composites [3-7]. Generally speaking, there are two major problems