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Processing, microstructure and ageing behavior of in-situ submicron TiB_2 particles reinforced AZ91 Mg matrix composites

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Abstract

In this paper, in-situ submicron TiB_2 particles (2.5 wt.%) reinforced AZ91 matrix composites are processed by the master alloy method combined with an optimized SHS technique. The effect of TiB_2 particles on the microstructure, ageing behavior and mechanical properties of Mg matrix composites is investigated. The results reveal that only TiB_2 phase is in-situ formed in the Al-TiB_2 master alloy and exhibits the size distribution of 100 nm to 700 nm. Compared with the unreinforced AZ91 alloy, the grain size and morphology of $Mg_{17}Al_{12}$ phase in as-cast composites are much refined. The ageing process of composites is accelerated and the peak-aged time of composites decreases from 42 h to 22 h significantly with the introduction of TiB_2 particles. Large numbers of fine $Mg_{17}Al_{12}$ in composites preferentially precipitate at grain boundaries and near TiB_2 particles regions. In addition, the hardness, yield strength, ultimate tensile strength and elongation of as-cast composites are improved by 16.1%, 53.0%, 26.3% and 25.6%, respectively. After T6 heat treatment, the strength of composites is increased further due to large amounts of submicron $Mg_{17}Al_{12}$ phase, and the age hardening efficiency of composites is higher than that of AZ91 alloy.

Keywords: In-situ; Mg matrix composites; Microstructure; Ageing behavior; Mechanical properties

1. Introduction

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