

Accepted Manuscript

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PII: S0925-8388(18)32089-9

DOI: [10.1016/j.jallcom.2018.05.351](https://doi.org/10.1016/j.jallcom.2018.05.351)

Reference: JALCOM 46327

To appear in: *Journal of Alloys and Compounds*

Received Date: 7 April 2018

Revised Date: 28 May 2018

Accepted Date: 29 May 2018

Please cite this article as: P. Xiao, Y. Gao, X. Yang, F. Xu, C. Yang, B. Li, Y. Li, Z. Liu, Q. Zheng, Processing, microstructure and ageing behavior of in-situ submicron TiB₂ particles reinforced AZ91 Mg matrix composites, *Journal of Alloys and Compounds* (2018), doi: 10.1016/j.jallcom.2018.05.351.

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Processing, microstructure and ageing behavior of in-situ submicron TiB₂ particles reinforced AZ91 Mg matrix composites

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Abstract

In this paper, in-situ submicron TiB₂ particles (2.5 wt.%) reinforced AZ91 matrix composites are processed by the master alloy method combined with an optimized SHS technique. The effect of TiB₂ particles on the microstructure, ageing behavior and mechanical properties of Mg matrix composites is investigated. The results reveal that only TiB₂ phase is in-situ formed in the Al-TiB₂ 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 Mg₁₇Al₁₂ 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 TiB₂ particles. Large numbers of fine Mg₁₇Al₁₂ in composites preferentially precipitate at grain boundaries and near TiB₂ 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 Mg₁₇Al₁₂ 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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