Effects of heat-treatment on the interfacial reaction and tensile properties of Al_2O_3 coated-$Al_{18}B_4O_{33}$w/Al–Mg matrix composites

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Effects of heat-treatment on the interfacial reaction and tensile properties of Al_2O_3 coated-$Al_{18}B_4O_{33}$w/Al-Mg matrix composites

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Abstract

Al-Mg matrix composites reinforced by $Al_{18}B_4O_{33}$ whiskers with and without Al_2O_3 coating were fabricated by squeeze casting. The effects of heat treatment on the microstructures and tensile properties of the composites were investigated. The results indicated that the heat treatment strongly affects the interphase, the precipitation phases, and the dislocation states in the matrices of the composites. This leads to great changes in the tensile properties of the composites during the heat-treatment process. The heat treatment does not affect the interface reaction of the composite with raw whiskers, but affects that of the composite-contained coated whiskers. After heat treatment for 20 h, a new interface phase of $MgAl_2O_4$ forms in the composite-contained coated whiskers, which is responsible for the low tensile properties. In addition, the dislocation states and the precipitation phases affect the tensile properties of the composites distinctly. A suitable heat-treatment process can be found for the ultimate tensile strength and elongation to fracture.

Keywords: Heat treatment; Coatings; Aluminum matrix composite; Interfaces; Mechanical property;

1. Introduction

Aluminum matrix composite reinforced by aluminum borate whisker ($Al_{18}B_4O_{33}$ whisker,

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