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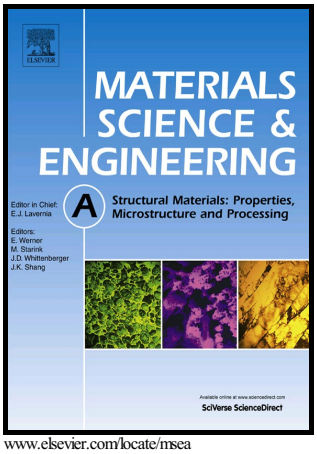

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Enhanced fatigue crack propagation resistance of Al-Cu-Mg alloy by intensifying Goss texture and refining Goss grains

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Abstract

The effect of intensifying Goss texture and refining Goss grains on the enhancement of fatigue crack propagation (FCP) resistance in an Al-Cu-Mg alloy was systematically investigated. The way to improve fatigue performance mainly includes two steps: intensifying Goss texture component and then refining these Goss grains. Hot rolling at elevated temperature and pre-solution treatment are capable of Goss texture formation. Then large cold rolling reduction can refine grains and obtain more these Goss grains, which increases the twist angle boundary components with their adjacent grains to enhance fatigue crack deflection and FCP resistance. By contrast, refining Brass etc. rolling-oriented grains can increase the tilt angle boundary components and promote fatigue crack growth. And the reason why grain refinement cannot always improve fatigue properties in alloys with micrometer grains can depend mainly on grain orientations and the relative boundary components in this Al-Cu-Mg alloy. Besides, coarse Fe-, Si- and Mn-rich inclusions are detrimental to fatigue properties, but the fine, globular and homogeneous distribution of these particles can improve fatigue properties to some extent.

Keywords: Grain orientation; Grain refinement; Inclusions; Fatigue crack propagation; Al-Cu-Mg alloy.

1. Introduction

Al-Cu-Mg aluminum alloy is widely used in aerospace applications due to the excellent mechanical properties, especially fatigue properties. In order to further improve fatigue performance of this alloy, considerable efforts have been made to reveal the microstructure effect on fatigue behavior.

Researches [1-3] revealed that large Cu-Mg and Mg-Ag co-clusters were difficult to re-dissolve