Accepted Manuscript

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PII: S0925-8388(17)33382-0

DOI: 10.1016/j.jallcom.2017.09.320

Reference: JALCOM 43376

To appear in: *Journal of Alloys and Compounds*

Received Date: 5 May 2017

Revised Date: 17 July 2017

Accepted Date: 28 September 2017

Please cite this article as: W. Wu, Z. Liu, Y. Hu, F. Li, S. Bai, P. Xia, A. Wang, C. Ye, Goss texture intensity effect on fatigue crack propagation resistance in an Al-Cu-Mg alloy, *Journal of Alloys and Compounds* (2017), doi: 10.1016/j.jallcom.2017.09.320.

Goss texture intensity effect on fatigue crack propagation resistance in an Al-Cu-Mg alloy

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Abstract

Goss texture intensity effect on fatigue crack propagation (FCP) resistance in an Al-Cu-Mg alloy sheet is investigated by X-ray diffraction (XRD), scanning electron microscopy (SEM) and electron back scattering diffraction (EBSD). Results show that sheet with high intensity Goss texture presents a lower FCP rate than relatively low intensity Goss-texture one. Greater crack deflections in the high intensity Goss texture sheet are observed during FCP, resulting in a rougher fracture surface and a greater roughness induced crack closure (RICC) effect, comparing to the low intensity Goss texture sheet. A modified crystallographic model is developed to calculate the twist angle and tilt angle between neighboring grains. Therefore, fatigue crack deflection occurred during FCP could be analyzed and understood.

Keywords: Fatigue crack propagation; Goss texture; Crystallographic model; Al-Cu-Mg alloy thick sheet.

1. Introduction

The Al-Cu-Mg aluminum alloys, known for their moderate strength, low density and good damage tolerance characteristics, have been widely used in aerospace applications [1, 2]. As is known, fatigue failure is one major cause of air crashes [3, 4], and therefore fatigue properties have been a main concern of material scientists [5, 6].