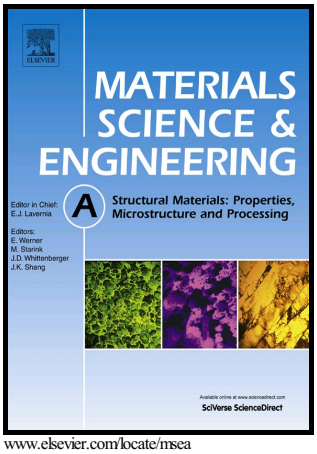
Investigating the temperature dependency of plastic deformation in a Mg-3Al-1Zn alloy

Adrien Chapuis, Qing Liu



www.elsevier.com/locate/msea

PII: S0921-5093(18)30515-X
DOI: https://doi.org/10.1016/j.msea.2018.04.019
Reference: MSA36339

To appear in: *Materials Science & Engineering A*

Received date: 16 January 2018
Revised date: 15 March 2018
Accepted date: 5 April 2018

Cite this article as: Adrien Chapuis and Qing Liu, Investigating the temperature dependency of plastic deformation in a Mg-3Al-1Zn alloy, *Materials Science & Engineering A,* https://doi.org/10.1016/j.msea.2018.04.019

Investigating the temperature dependency of plastic deformation in a Mg-3Al-1Zn alloy

Adrien Chapuis*, Qing Liu

College of Materials Science and Engineering, Chongqing University, Chongqing 400044, China

*Corresponding author. Adrien Chapuis. achapuis@cqu.edu.cn

Abstract

During the deformation of magnesium alloys, increasing temperature is known to favor secondary slip modes and suppress twinning. In this study, an Mg-3Al-1Zn O-temper plate was deformed by plane strain compression at 20 to 450ºC, and visco-plastic self-consistent modeling was used to evaluate the CRSS of different deformation modes at different temperatures. Results show that the CRSS for $\{10\bar{1}2\}$ tension twinning increases, and $\{10\bar{1}1\}$ compression twinning is not observed above 150ºC. At 250ºC and above, prismatic and pyramidal <c+a> slip have the same initial CRSS. The CRSS values estimated at different temperatures are used to simulate several types of deformation behavior.

Keywords: Magnesium alloy; AZ31; crystal plasticity; VPSC; plane strain compression

1. Introduction

Plastic deformation capability of magnesium and its alloys is limited at room temperature but is improved at higher temperature [1, 2], because the activated deformation mechanisms and mechanical behavior vary. It is widely accepted that basal slip is the easiest slip system, while twinning is dramatically activated at low temperature, and several slip modes predominate at high temperature (e.g.[1-4]).

In fact, at room temperature (RT), tension $\{10\bar{1}2\}$ [5] and contraction $\{10\bar{1}1\}$ twinning [6] are largely activated [7]. But secondary slip modes, such as prismatic and pyramidal <c+a> slip, are