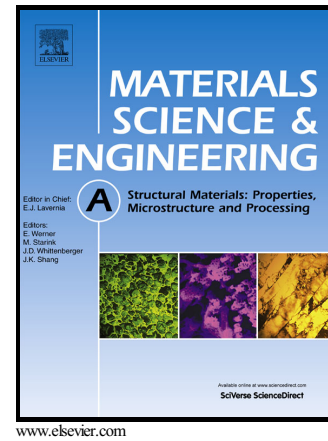


Author's Accepted Manuscript

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PII: S0921-5093(15)00501-8
DOI: <http://dx.doi.org/10.1016/j.msea.2015.04.094>
Reference: MSA32318

To appear in: *Materials Science & Engineering A*

Received date: 13 March 2015
Revised date: 28 April 2015
Accepted date: 28 April 2015

Cite this article as: D.A. Zhemchuzhnikova, M.A. Lebyodkin, T.A. Lebedkina and R.O. Kaibyshev, Unusual behavior of the Portevin-Le Chatelier effect in an AlMg alloy containing precipitates, *Materials Science & Engineering A*, <http://dx.doi.org/10.1016/j.msea.2015.04.094>

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Unusual behavior of the Portevin-Le Chatelier effect in an AlMg alloy containing precipitates

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Abstract

Stress serration patterns and kinematics of deformation bands associated with the Portevin–Le Chatelier effect in an Al–Mg alloy were investigated by analyzing the evolution of the applied stress and axial strain distribution. In contrast to usually observed strain localization behaviors, referring to propagating and static deformation bands at high and low strain rates, respectively, the propagation mode was found to persist in a wide strain-rate range. This unusual behavior is discussed in relation with the role of precipitates.

Keywords: aluminum alloys; mechanical characterization; precipitation; plasticity; deformation bands

1. Introduction

Due to their low weight and high mechanical strength, Al–Mg alloys are important technological materials for diverse applications in transportation industry [1,2]. However, their formability suffers from the phenomenon of plastic flow instability known as the Portevin–Le Chatelier (PLC) effect [1,3]. It characterizes mechanical behavior of various alloys and is generally attributed to dynamic strain aging (DSA), a mechanism caused by interaction between the mobile solute atoms and dislocations [4]. The instability occurs in some ranges of

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