Accepted Manuscript

Effects of second phases on deformation behavior and dynamic recrystallization of as-cast Mg-4.3Li-4.1Zn-1.4Y alloy during hot compression

Yucheng Zhou, Zhaoyun Chen, Jinghan Ji, Zhijie Sun

PII: S0925-8388(18)33013-5

DOI: 10.1016/j.jallcom.2018.08.129

Reference: JALCOM 47217

To appear in: *Journal of Alloys and Compounds*

Received Date: 29 May 2018

Revised Date: 18 July 2018

Accepted Date: 15 August 2018

Please cite this article as: Y. Zhou, Z. Chen, J. Ji, Z. Sun, Effects of second phases on deformation behavior and dynamic recrystallization of as-cast Mg-4.3Li-4.1Zn-1.4Y alloy during hot compression, *Journal of Alloys and Compounds* (2018), doi: 10.1016/j.jallcom.2018.08.129.

Effects of second phases on deformation behavior and dynamic recrystallization of as-cast Mg-4.3Li-4.1Zn-1.4Y alloy during hot compression

Yucheng Zhou, Zhaoyun Chen*, Jinghan Ji, Zhijie Sun

Institute of Corrosion Science and Surface Technology, Key Laboratory of Superlight Materials & Surface Technology, Ministry of Education, College of Material Science and Chemical Engineering, Harbin Engineering University, Harbin, China

Abstract

Hot compression and dynamic recrystallization (DRX) behavior corresponding to the second phases of as-cast Mg-4.3Li-4.1Zn-1.4Y (wt.%) alloy was investigated in the range of 250-450 □ and 0.001-10 s^{-1}. True strain-true stress curves showed typical characteristics DRX process. Constitutive relationship yielded an average activation energy (Q) and stress exponent (n) of 147.183 kJ/mol and 5.49, respectively. The hot deformation was mainly controlled by climb of edge dislocations, which turned into cross-slip of screw dislocations at ≥400 □. The volume fraction of second phases changed the dislocation movement and resulted in the variation of the rate-controlling mechanism. The peak power dissipation efficiency (η) was observed at 450 □/0.1 s^{-1} (32 %), and the corresponding uniform and fine microstructure was attributed to the dynamic precipitation and complete DRX from uniformly distributed second phase particles. A wide flow instability region was observed at all temperatures and relatively high strain rates, corresponding to the non-uniform microstructure of the incomplete DRX and deformation band composed of ultrafine DRXed grains, which resulted from local distributed second phase particles. DRX process was attributed to the nucleation at second phase particles by the mechanism of particle stimulated nucleation (PSN), and the incomplete DRX process was accompanied by the dynamic recovery (DRV) process.

Key words: Mg-Li alloy; Hot deformation; Kinetic analysis; Processing map; Dynamic recrystallization

Corresponding author: Chen Zhaoyun, Master., Professor, College of Materials Science and Chemical Engineering, Harbin Engineering University, Harbin 150001, P.R. China, Tel:0086-451-82518219, E-mail: zhaoyunchenlaoshi@126.com