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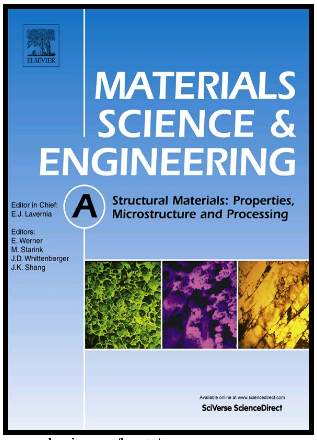

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Influences of warm rolling and annealing processes on microstructure and mechanical properties of three parent structures containing Mg-Li alloys

Yan Tang [a], Qichi Le [a,*], Weitao Jia [a], Xuan Liu [b], Jianzhong Cui [a]

[a] Key Lab of Electromagnetic Processing of Materials, Ministry of Education, Northeastern University, Shenyang 110819, China

[b] School of metallurgy and ecology engineering, University of Science & Technology Beijing, Beijing 100083, China

Abstract

The microstructural evolution and mechanical properties of Mg-xLi-3Al-2Zn-0.2Y (x=5, 8 and 11) alloys under the different rolling temperatures and annealing routes were investigated. The results showed that the Li addition transformed gradually the Mg crystal structure from hcp to bcc. With ascending rolling temperature, the Mg-11Li-3Al-2Zn-0.2Y (LAZ1132-0.2Y) alloy achieved the dynamic recrystallization behavior in advance, as compared with Mg-5Li-3Al-2Zn-0.2Y (LAZ532-0.2Y) and Mg-8Li-3Al-2Zn-0.2Y (LAZ832-0.2Y). Moreover, {0002} basal texture in LAZ532-0.2Y was weakened gradually by ascending rolling temperature. In LAZ832-0.2Y, {11-20} texture component relatively kept stable when the {0002} basal texture was weakened. When rolling at 503 K, a new {211} <201> texture was observed in LAZ1132-0.2Y. In the annealing process, a kind of abnormal grain growth took place in LAZ1132-0.2Y. In addition, a strengthening behavior could be accomplished by strengthening β matrix (bcc).

Key words: Rolling temperature; Annealing; Texture; Strengthening

1. Introduction

Magnesium-lithium (Mg-Li) alloys are treated as the lightest metallic structural materials on earth [1]. In the past few decades, Mg-Li alloys have got the increasing attention in many fields of automobile, aerospace, military and electronic industry because of their attractive properties including low density, good damping ability, high elastic modulus, high specific strength and stiffness, outstanding electromagnetic shielding property and high energetic particle penetration resistance [2-5]. Furthermore, when Li content is below 5.7 mass%, Mg-Li alloy mainly reveals α-Mg phase [6]. When Li content is between 5.7% and 10.3 mass%, Mg-Li alloy mainly consists of α-Mg and β-Li phases [7-10]. When Li content is beyond 10.3 mass%, Mg-Li alloy mainly consists of β-Li phase [11]. The Li addition improves effectively the plastic deformation of Mg alloys. However, the strength of Mg-Li alloys is relatively low, which would limit their widespread application in the national economy. Thereby, many researchers have adopted some positive methods to solve the problem, such as adding Zn, Al and rare earth elements, severe deformation process (equal channel angular extrusion and hot extrusion) and so on [4-20].

From the previous works, it was well known that Mg-Li-Al alloys were considered as main hardening alloys by means of ageing hardening at ambient temperature. Many researchers have reported them [8-20]. However, Mg-Li alloys strengthened by the combination of warm rolling and solid solution were few reported. In this paper, the effects of rolling temperatures and annealing routes on microstructural evolution and mechanical properties of Mg-xLi-3Al-2Zn-0.2Y

* Corresponding author.
E-mail address: qichil@mail.neu.edu.cn (Q. Le).