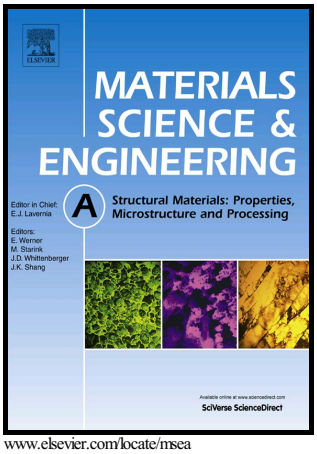
Role of one direction strong texture in stretch formability for ZK60 magnesium alloy sheet

Wenke Wang, Limin Ma, Shaochun Chai, Wencong Zhang, Wenzhen Chen, Yangju Feng, Guorong Cui



www.elsevier.com/locate/msea

PII: S0921-5093(18)30780-9
DOI: https://doi.org/10.1016/j.msea.2018.05.113
Reference: MSA36551

To appear in: *Materials Science & Engineering A*

Received date: 23 April 2018
Revised date: 28 May 2018
Accepted date: 31 May 2018

Cite this article as: Wenke Wang, Limin Ma, Shaochun Chai, Wencong Zhang, Wenzhen Chen, Yangju Feng and Guorong Cui, Role of one direction strong texture in stretch formability for ZK60 magnesium alloy sheet, *Materials Science & Engineering A,* https://doi.org/10.1016/j.msea.2018.05.113

Role of one direction strong texture in stretch formability for ZK60 magnesium alloy sheet

Wenke Wang[a], Limin Ma[a], Shaochun Chai[b], Wencong Zhang[a], Wenzhen Chen[a,*], Yangju Feng[a], Guorong Cui[a]

[a]School of Materials Science and Engineering, Harbin Institute of Technology, Weihai 264209, PR China

[b]Zibo Deyuan Metal Materials Co., Ltd, Zibo 255000, PR China

[*]Corresponding author. Postal Address: Room A301, School of Materials Science and Engineering, Harbin Institute of Technology, Weihai 264209, PR China. Tel.: +86 631 5672167; fax: +86 631 5672167. E–mail address: nclwens@hit.edu.cn (Wenzhen Chen)

Abstract:

Three ZK60 resulting sheets with same grain size but various texture states were successfully fabricated by a combination process of hot rolling, cold rolling and annealing treatment. Subsequently, standard Erichsen tests were performed on these resulting sheets which possessed orthotropic basal texture exhibiting an egg-shaped asymmetric distribution of basal poles from the normal direction. Combining with the analysis of strain hardening ability obtained from uniaxial tension test, it could be concluded that the magnesium alloy sheets with orthotropic basal texture presented anisotropy in strain hardening ability, and their stretch formability was dependent on the strong texture in one direction of magnesium alloy sheets. That was to say, texture weakened only in single direction could not improve the stretch formability. This conclusion was supported more by the direction of crack propagation which was parallel to the weak texture direction of magnesium alloy sheet.

Keywords: ZK60; Stretch formability; Texture; Crack

1 Introduction

Due to the high specific strength and low density, magnesium alloys are the lightest structural metal, and their application is expanding, especially in aerospace and automotive industries [1]. However, their inherent hexagonal close packed (HCP) structures usually produce strong basal texture because their critical resolved shear stress (CRSS) of basal slip is much lower than non-basal slip. This leads to their poor sheet formability under the room temperature, which greatly limits their widespread commercial usability [2, 3].