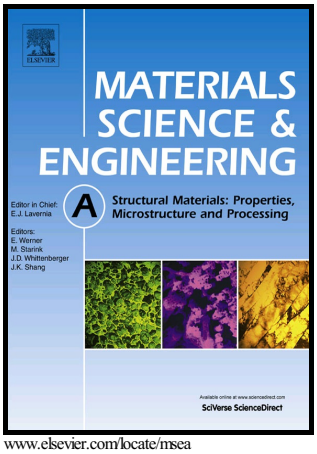
The effect of nano β-TCP on hot compression deformation behavior and microstructure evolution of the biomedical Mg-Zn-Zr alloy

Haoran Zheng, Zhen Li, Minfang Chen, Chen You, Debao Liu



www.elsevier.com/locate/msea

PII: S0921-5093(18)30006-6
DOI: https://doi.org/10.1016/j.msea.2018.01.006
Reference: MSA35960

To appear in: *Materials Science & Engineering A*

Received date: 5 September 2017
Revised date: 29 November 2017
Accepted date: 2 January 2018

Cite this article as: Haoran Zheng, Zhen Li, Minfang Chen, Chen You and Debao Liu, The effect of nano β-TCP on hot compression deformation behavior and microstructure evolution of the biomedical Mg-Zn-Zr alloy, *Materials Science & Engineering A,* https://doi.org/10.1016/j.msea.2018.01.006

The effect of nano β-TCP on hot compression deformation behavior and microstructure evolution of the biomedical Mg-Zn-Zr alloy

Haoran Zheng [1], Zhen Li [1], Minfang Chen[1*], Chen You [1], Debao Liu [1]

[1]School of Materials Science and Engineering, Tianjin University of Technology, Tianjin, 300384, China

[2] Tianjin Key Lab for Photoelectric Materials & Devices, Tianjin, 300384, China

*** Corresponding Author email: mfchentj@126.com**

Abstract

Aiming to investigate the effects of nano β-tricalcium phosphate (β-TCP) on the hot deformation mechanism of Mg-Zn-Zr alloy (MZZ) and confirm the optimum hot working conditions of 2β-TCP/Mg-3Zn-0.8Zr composites (MZZT), thermal simulation test at deformation temperature and strain rate in the range of 523-673K and 0.001-1s^{-1} was performed on MZZ and MZZT by using Gleeble-1500 simulator. The results of strain-stress behavior indicated that the flow stress of MZZT is higher than that of MZZ under the same hot deformation condition in the deformation temperature range of 523-623K, whereas this trend opposed when specimens deformed at 673K. Based on the establishment of constitutive equation, the average activation energy of MZZT for hot deformation is calculated to be 184.1 kJ/mol, and almost 60 kJ/mol higher than that of MZZ which can be attributed to the increasing of deformation resistance after the addition of β-TCP particles. Furthermore, according to the processing map constructed at strains of 0.8 and microstructure observation, the optimum hot working condition for MZZT with higher value of power dissipation (37%) is determined to be 600-645K and 0.01-0.001s^{-1}.

Keyword: β-TCP/Mg-Zn-Zr composite; hot deformation; processing map; dynamic recrystallization

1 Introduction

Magnesium (Mg) and its alloys exhibit significant advantages and potential for using as orthopedic application, intravascular stent and hemostatic clamp because of their high specific strength, good biocompatibility and biodegradable absorbent [1-3]. However, contrast to the 316L, Ti6Al4V and other metallic materials which have been widely used in clinic, the practical use of Mg alloys is hindered by