Interdiffusion kinetics of the intermetallic coatings on AZ91D magnesium alloy formed in molten salts at lower temperatures

Jingjing Le, Lei Liu, Fan Liu, Yida Deng, Cheng Zhong, Wenbin Hu

PII: S0925-8388(14)01042-1
DOI: http://dx.doi.org/10.1016/j.jallcom.2014.04.209
Reference: JALCOM 31174

To appear in:

Received Date: 26 February 2014
Revised Date: 26 April 2014
Accepted Date: 28 April 2014

Please cite this article as: J. Le, L. Liu, F. Liu, Y. Deng, C. Zhong, W. Hu, Interdiffusion kinetics of the intermetallic coatings on AZ91D magnesium alloy formed in molten salts at lower temperatures, (2014), doi: http://dx.doi.org/10.1016/j.jallcom.2014.04.209

Interdiffusion kinetics of the intermetallic coatings on AZ91D magnesium alloy formed in molten salts at lower temperatures

Jingjing Le, Lei Liu, Fan Liu, Yida Deng, Cheng Zhong*, and Wenbin Hu

State Key Laboratory of Metal Matrix Composites, Shanghai Jiao Tong University, Shanghai 200240, China

Abstract: A continuous Mg–Al diffusion coating can be formed on the AZ91D Mg alloy by the diffusion coating treatment in molten salts in the lower temperature range from 280 to 400 °C. The microstructure and composition of the diffusion coatings were investigated by scanning electron microscopy and energy dispersive X-ray analysis. The results showed that the diffusion coating consists of continuous γ-$Mg_{17}Al_{12}$ phase and β-Mg_2Al_3 phase. The β-Mg_2Al_3 phase layer grows faster than the γ-$Mg_{17}Al_{12}$ phase layer. The interdiffusion coefficients for each phase were investigated by Heumann's method. As the temperature increases from 320 to 400 °C, the interdiffusion coefficient in γ-$Mg_{17}Al_{12}$ phase ($\widetilde{D}_\gamma$) increases from 2.2×10^{-12} to 9.6×10^{-11} cm^2/s. When the temperature increases from 360 to 400 °C, the interdiffusion coefficient in β-Mg_2Al_3 phase ($\widetilde{D}_\beta$) increases from 3.5×10^{-10} to 7.4×10^{-10} cm^2/s. The activation energies for the interdiffusion in γ-$Mg_{17}Al_{12}$ and β-Mg_2Al_3 phases are 155.9 and 66.3 kJ/mol, respectively.

Keywords: Magnesium alloy; Intermetallic coatings; Molten salt; Diffusion;

* Corresponding author. Tel.: +86 21 34202981; fax: +86 21 34202981.

E-mail address: czhongcn@gmail.com (C. Zhong)