Chromate and Permanganate Conversion Treatment of AZ31 Magnesium Alloys

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ABSTRACT

In this study, AZ31 magnesium alloys was treated with Dow 17 chromate solutions first since understanding the microstructure and formation mechanis m of chromate conversion coatings would provide a basis for seeking alternatives to chromate conversion coatings. Then, the alloys were immersed in permanganate/phosphate solutions at different temperatures for various immersion time so as to investigate the structural evolution of the coatings and their corrosion-resistance properties. Experimental results indicate that the color, growth behavior, microstructure and properties of chromate and permanganate/phosphate conversion coatings can be controlled by the composition of the solution and the operating parameters such as solution temperature and immersion time. The growth of chromate coatings obeys a parabolic law, while that of permanganate/phosphate coatings depends strongly on the solution temperature. For example, thickness and growth rate of permanganate/phosphate coatings increase with increasing solution temperature. This dependence on the solution temperature is related to the microstructure of the coating. For the immersion in solutions at high temperature, a compact magnesium oxide forms as an interlayer between the conversion coating and the magnesium substrate, and effectively retards the conversion reaction. Finally, the permanganate/phosphate coatings, when thick enough, provide a corrosion resistance similar to that of chromate coatings as shown in polarization curves.

Keywords : magnesium alloys, chromate conversion coating, permanganate/phosphate coatings, polarization curve, film thickness

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REFERENCES

[1] Y. Kaniojima, ‵Project of Platform Science and Technology for -Advanced Magnesium Alloys,′ Materials Transcations,Vol.42, -2001 , pp.1154-1159.

[2] ‵鎂合金產業資訊′，鎂合金產業通訊，第13 期，2001， -pp.129-133.

[3] K. Funatani, ‵Emerging Technology in Surface Modification of -Light Metals,′ Surface and Coating Technology, Vol.133- 134 , -2000, pp.264-272.

[4] ‵鎂合金買主及製造商最佳福音:21 世紀金屬表面處理重大突 破′，至真生化科技股份有限公司。

[5] 陳建仲，潘有涵，朝春光， ‵鎂合金之表面改質′，中國材料科 學學會2002 年度年會，PK-09。

[6] T. Biestek and J. Weber, Electrolytic and Chemical Conversion -Coatings,1st ed, Portcullis Press Ltd. , Poland , 1976, pp.208-210, -306-311.

[7] S .Ono, K. Asami and N. Masuko, ‵Mechanism of chemical -Conversion Coating Film Growth on Magnesium and magnesium -Alloys,′ Materials Transactions,Vol.42,2001,pp.1225-1231.

[8] S. Ono, M. Saito, M. Horiguchi, K. Terashima, K. Masuko, A. -Shida, T. Osaka and N. Masuko, ‵Structure and Formation -Mechanism of Surface Film Formed on Magnesium Die Cast -AZ91D by Chemical Conversion Coating,′ 表面技術, Vol.47,1996, -pp.263- 267 .

[9] D. Hawke and K. Gaw, ‵Effects of Chemical Surface Treatments -on the Performance of an Automotive Paint System on Die Cast -Magnesium,′ SAE Technical Paper 920074,Society of Automotive -Engineers,Pittsburigh,1992.

[10] S. Ono,K. Asami,T. Osaka and N. Masuko, ‵Structure of Anodic -Films Formed on magnesium″ J.Electrochem.Soc.,Vol.143,1996, -pp.L62-L63 [11] S. Ono, M. Saito, M. Horiguchi, K. Terashima, K. Matsusaka, A. -Shida , T. Osaka and N. Masuko, ‵Structure and growth -Mechanism of Anodic Films Formed on Magnesium Die Cast -AZ91D,″ 表面技術 ,Vol.47 , 1996 , pp.268-272.
[12] O. Khaselev and J.Y ahalom, ‵Constant Voltage Anodizing of -Mg-Al Alloys in KOH-Al(OH)3, ″ J. Electrochem. Soc ,. -Vol.145,1998, pp.190-193.
[13] W. Kobayashi and S. Takahaka, ‵Aqueous Anodizing Solution -and Process for Coloring Article of Magnesium or -Magnesium-Based Alloy, ″ US Patent 4551211,1985.
[14] W. Kobavashi, K. Uehori and M. Furuta, ‵Anodizing Solution for -Anodic Oxidation Article of Magnesium or Its Alloy,″ US Patent -4744872,1998.
[15] O. KozaK ‵Anto-Corrosive Coating on Magnesium and Its -Alloy,″ US Patent 4184926,1980.
[16] E. L. Schmeling, B. Roschenbleck and M. H. Weidemann - ‵Method of producing Protective Coatings That Are Resistant -to Corrosion and Wear on Magnesium and Magnesium Alloys″ -US Patent 4978432,1990.
[17] G. Yamauchi,K. Arita,J. Seki, E. Sakita,M.Mino,Y.Matsudaira,Y. -Miyata,J. Masuda and Y.Koide, ‵Surface-Treated Magnesium or -Magnesium Alloy, and Surface Treatment Process Therefor,″ US -Patent 4770946,1998.
[18] Y. Xiang,W. Hu,X. Liu,C. Zhao and W. Ding, ‵A Study on -Surface State during the Pretreatment of Electroless Nickel -Plating on Magnesium Alloys,″ Trans IMF,Vol.79,2001,pp.27-29.
[19] Y. Xiang,W. Hu,X. Liu,C. Zhao and W.Ding, ‵Initial Deposition -Mechanism of Electroless Nickel Plating on Magnesium -Alloys,″ Trans IMF,Vol.79,2001,pp.30-32.
[20] A.Yamamoto,A.Wantanabe,K.Sugahara,S.Fukumoto and H. -Tsubakino ‵Deposition Coating of Magnesium Alloys with Pure -Magnesium, ″ Materials Transactions,Vol.42,2001,pp.1237-1242.
[21] A.Yamamoto,A.Watanabe,S.Fukumoto,K.Sugahara and H. -Tsubakino, ‵Surface Modification of Magnesium Alloys by a -Method of vapor Deposition of Magnesium,″ 輕金屬,Vol.20, -2000 , pp.619-620.