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 mechanism 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 times 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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