The Difference of Structure and Growth Mechanism of Phosphate and Vanadate Coatings on AZ31B Magnesium Alloy

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ABSTRACT

In the study two types of conversion solutions, phosphate and vanadate solution, are selected to test AZ31B magnesium alloy. The operating parameters studied included the solutions temperature and immersion time, investigating the difference of structure and growth mechanism between these two solutions. Using SEM and polarization test to observe the morphology of coatings and corrosion resistance, in addition the measurement of roughness and adhesion test are carried out to test the shear strength of coatings. From experimental results show the zinc phosphate coating is crystalline coating contain two layers. At 45°C conversion temperature, with increasing the immersion time, the crystalline structure of upper layer will be grew larger and thicker. However, at 30°C, can observe the lower cracking layer exposed because the upper layer can not completely cover the lower layer. And, the sodium vanadate coating is non-crystalline coating, the growth of coating seems follow the pre-treatment process direction. With increasing the solution temperature and immersion time can find the dense coating layer formed. Maybe due to the dehydration and environment effects, the surface of coating shows the random cracking state. Shearing test results reveal that zinc phosphate coatings contain two layers, from tests only can measure the shear strength between upper and lower layer, and the value of strength is not good. This result means that the bonding strength between upper and lower layer is very easy to depart. However, the sodium vanadate coating is a type of cracking layer, and the adhesive can easily infiltrate into the surface of base metal, so the value of shear strength ranging from 14 to 16 MPa. In corrosion resistance tests, the polarization curve state, zinc phosphate coating exist the minimum corrosion current density (2.41×10-6 Amps/cm2) under 45°C solution temperature and 30 minutes immersion time treatment. However, with increasing the immersion time, the thickness of upper layer may further increased, but the thicker coating layer will very easy to peel off which is due to the internal stress, and the corrosion current density increase again. However, sodium vanadate coating can also find the minimum corrosion current density under 10 minutes immersion time and 25°C solutions temperature. If further bring the solution temperature up to 60°C, exists minimum corrosion current density (0.93×10-7 Amps/cm2).

Keywords : AZ31B Magnesium Alloy ; Zinc Phosphate Conversion Treatment ; Sodium Vanadate Conversion Treatment ; Polarization Curve ; Corrosion Current Density

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