The Structure Strength and Growth Mechanism of AZ91D Magnesium Alloy Conversion Coatings

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ABSTRACT

As result of the development of technology and consumers ’ demands, the designs of new products become smaller and lighter, also the fully functional outfits are equipped. In addition, due to the prosperity of environmental protection, the lightness of transportation vehicle, reducing the emission of pollution, and the consideration of increasing the fuel efficiency, the use of lightening material gradually attracts attentions nowadays. In recent years, the prosperity of information industry has leaded to the significant use of light-materials which mainly refer to magnesium, aluminum and titanium. Among these materials, magnesium alloys will be the dominated material because of its excellent characteristics including low specific density, high specific strength and rigidity, good thermal conductivity, high damping capacity and electromagnetic interference, etc. However, magnesium alloys exists high activity, low electrochemical potential behaviors which will oxidize easily. It is necessary applying appropriate surface treatment to prevent corrosion. In this study, AZ91D magnesium alloy is used as experimental material. Meanwhile, permanganate and phosphate conversion coatings, which are widely used for surface treatment in industries, are adapted to have fundamental discussions. The operation parameters studied included the solution temperature and immersion time, used OM, SEM (EDS) and XRD to observe the surface morphology of coatings and analyze the chemical composition. Normally, products would follow-up coating after conversion treatment, thus, conversion coating plays the role of corrosion resistance in a short time. In the last, using adhesives to do the adhesion test and obtain the shear strength of conversion coatings directly. Obeying these data, we can judge the capability of adhesion and wear resistance. From experimental results shown that the surface cracks of permanganate conversion coatings were amorphous, and the thickness and weight increased with increasing immersion time. However, the coating of phosphate conversion is non-crystal layers and randomly distributed. The size of surface product grows with immersion time increased and the morphology without change apparently. In the aspect of shear strength, at 60°Cand 80°C permanganate conversion specimens, the coating strength increased after 10 minute immersion time which is due to the dense MgO structure formation. However, in phosphate conversion treatment, the strength do not show apparently changed under various operation conditions. The fracture surface always occurs between adhesives and base metal or at the interface of adhesives and coatings. Overall, the non-crystal phosphate conversion coating exist better shear strength than permanganate coating. This result illustrate phosphate coating with regard to follow-coating layer has better adhesion ability, also can provide better corrosion resistance protection.

Keywords : AZ91D Magnesium Alloy、Permanganate Conversion Coatings、Phosphate Conversion Coatings、Adhesion.

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