Study the Growth Mechanism and Corrosion Resistance of Rare Earth Magnesium Alloy Conversion Coating

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ABSTRACT

In this pursuit of lightness, versatility and recycling generation, magnesium alloys have been increasingly used in products of various fields, which is due to its low specific gravity, high specific strength and specific stiffness, good electromagnetic shielding and high recycling rates, etc. However, due to the nature of great activity, poor electrochemical performance, it is vulnerable to corrode by environment, therefore, appropriate surface treatment is generally required to impart corrosion-prevention function to magnesium metal. In this conversion treatment study, the AZ80A magnesium alloy plate with yttrium element containing as the experimental substrates, and this research divide into two stages. The first stage selects six types of conversion solution which commonly used in industries, under the selected conversion temperature to carry out with different immersion times, and then to observe the surface morphology by SEM and examine the corrosion current density of coating layer. The second stage is to carry out with different drying processes, and investigate the influences of corrosion resistance with drying methods. The first stage experimental results show that the conversion treatment with pH=3.5 manganate solution (nitric acid) for 10 minutes, and pH=9 vanadate solution for 5 minutes have the best corrosion resistance data and adequate coating morphology. It is because that coating completely covered with specimen in a short time, with intense and moderate thickness, also without found crack penetrating into substrate, which is believed to be beneficial to following adhesion processing. The results of second stage experiment (natural shade-drying or oven air-drying) show that all coating layers have relatively flat status without obvious cracks. Only the manganate layer separate out more precipitated phase rich with manganese during oven air-drying processing; believing the precipitated phase may affect the corrosion resistance performance. However, the morphology of vanadate coatings treats with different drying ways showing quite similar, which results in the same corrosion resistance behavior. From a viewpoint of the industrial manufacturing process demand (corrosion resistance and production rate), recommend to use pH=9 vanadate conversion solution for such AZ80A rare earth magnesium alloy, select 60°Cwith 5 minutes immersion time, and choose the method of 25°Coven air-drying 20 minutes for rapid drying, which should be the best combination of processing parameters. It is believed that can not only effectively improve the production rate, but also maintain the quality and economic benefit.

Keywords : AZ80A Rare Earth Magnesium Alloy, Conversion Treatment, Morphology of Coating, Polarization Test, Corrosion Current Density, Natural Shade-Drying, Oven Air-Drying.

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