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Plasma-Electrolytic-Oxidation Coating containing Y_2O_3 Nanoparticles on AZ91 Magnesium Alloy

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Yttrium oxide (Y_2O_3) nanoparticles were added to the electrolyte during the preparation of a plasma-electrolytic-oxidation (PEO) coating on the AZ91 Mg alloy. The effects of the Y_2O_3 nanoparticles on the microstructure, phase components, chemical compositions, and mechanical properties of the PEO coating were investigated by scanning electron microscopy (SEM), energy dispersive spectroscopy (EDS), X-ray diffraction (XRD), and microhardness tests. Furthermore, the corrosion resistance of the PEO coating was evaluated by pote ntiodynamic polarization curves and electrochemical impedance spectroscopy (EIS). The results indicated that the Y_2O_3 nanoparticles had been incorporated into the PEO coating and that the number of micropores and cracks in the coating was dramatically decreased. The microhardness of the PEO coating was more than 10 times higher than that of the AZ91 Mg substrate, and the corrosion current density decreased by approximately three orders of magnitude when 3 g/L of Y_2O_3 nanoparticles was added to the corresponding electrolyte.

Keywords: AZ91 Mg alloy, plasma-electrolytic-oxidation (PEO) coating, Y_2O_3 nanoparticle, corrosion resistance, microhardness

FULL TEXT