

عنوان مقاله:

Effects of Working Frequency on The Microstructure and Corrosion Resistance of Plasma Electrolytic Oxidation Coatings Formed on AZ₃₁ Mg Alloy

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خلاصه مقاله:

Plasma electrolytic oxidation is a novel and promising method for coating the light alloys especially magnesium alloys. Several parameters affect the coating quality and its properties, where in this study; the effects of frequency on properties of coatings produced by PEO on AZ₃₁ Mg alloy were investigated. The coating process was performed in a silicate-based electrolyte containing KF and K₂TiF₆ using a soft-sparking waveforms with 30 % cathodic pulse width at 1, 2, and 3 kHz. The surface morphology of the coatings was a net-like (scaffold) containing a micro-pores network, micro-cracks, and granules of oxide compounds, in which, no noticeable change on coating morphology occurred with increasing the frequency. Also, the coatings were composed of MgO, MgF₂, Mg₂SiO₄, SiO₂ (amorphous), and TiO₂ (crystalline and amorphous) phases contributed by the elements from both substrate and electrolyte in the coating process. Based on the cross-sectional images, the thickness of coatings displayed no significant increase with increasing in frequency, but the porosity percentage was increased. Also, the very small pores were presented in the inner layer with increasing frequency. Corrosion behavior of the coatings was evaluated using electrochemical impedance spectroscopy (EIS) in 3.5 wt. % NaCl until 7 days of immersion. The results of the EIS showed that with increasing frequency and porosity, the larger surface of the coating is in contact with the solution, and the presence of porosity in the more compact layer of the coating allowed the access of solution to the substrate, which reduces the barrier performance of the coating.

کلمات کلیدی:

AZ₃₁ Mg alloy, plasma electrolytic oxidation, frequency, corrosion resistance, آلیاژ منیزیم
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