

Functionalized hybrid PEO/Sol-gel Coatings for corrosion protection of Mg alloys

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Abstract:

Inhibitor-containing systems based on plasma electrolytic oxidation (PEO) coatings with a sol-gel top layer were developed on AZ31 Mg alloy to improve its corrosion resistance. 8-Hydroxyquinoline (HQ) inhibitor species were incorporated into the hybrid PEO/sol-gel system following two strategies: i) post-treatment of the PEO layer by immersion in an inhibitor containing solution, or ii) loading of the inhibitor into the sol-gel precursor. Characterization was carried out by scanning electron microscope (SEM), X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), ultraviolet-visible spectroscopy (UV-vis), and water drop contact angle measurements. The rheological behaviour of the sol-gel solutions was determined by measurement of the flow curves using a double-gap cylinder configuration. The corrosion process was studied in saline solution using electrochemical impedance spectroscopy (EIS) on unscratched samples and immersion tests with scratched specimens. Findings revealed successful incorporation of the inhibitor for both loading strategies. Regardless of the loading strategy, the systems containing HQ species revealed the best long-term corrosion performance.

Keywords: Corrosion; Magnesium alloys; Plasma electrolytic oxidation; Sol-Gel; organic inhibitor.
