Self-healing plasma electrolytic oxidation (PEO) coating developed by an assembly of corrosion inhibitive layer and sol-gel sealing on AA2024

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Abstract

The inherent porous structure of PEO coatings is regarded as a vital drawback for long-term protection as it provides diffusion pathways for an aggressive electrolyte. In this investigation, the presence of pores and defects in the PEO coating were exploited as reservoirs for corrosion inhibitors to generate self-healing properties. Smart sandwich-like coating systems were fabricated on the PEO oxide layer in which 8-hydroxyquinoline (8-HQ) and benzotriazole (BTA) were employed as corrosion inhibitive layer followed by the sol-gel sealing. Coating systems were characterized by Glow Discharge Optical Emission Spectroscopy (GDOES) and Scanning Electron Microscope (SEM) to illustrate the pore-filling ability of inhibitive layer and sol-gel sealing.

Corrosion protection performance and self-healing properties of fabricated coatings were electrochemically scrutinized by Scanning Vibrating Electrode Technique (SVET) and Electrochemical Impedance Spectroscopy (EIS) tests. Some crucial factors are of great importance to determine the dual barrier/active performance of the coating system including mechanical interlocking between the sol-gel coating and the sublayer (i), presence of inhibitors either inside of pores or in a form of a deposited layer over the PEO (ii), and sealing ability of sol-gel in the presence of the intermediate layer (iii).

Keywords: *Sol-gel sealing; Plasma electrolytic oxidation; GDOES; AA2024; SVET.*