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The Role of Zinc Phosphate Pigment in the Anticorrosion Properties of Bisphenol A Diglycidyl Ether-Polyaminoamide Coating for Aluminum Alloy AA2024-T3

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Abstract

This study is focused on an anticorrosive formulation as a coating an aluminum alloy AA2024-T3 to withstand marine environment. The anticorrosive formulation was based on an epoxy resin bisphenol-A diglycidyl ether that is cured with polyamine polyaminoamide. The anticorrosive formulation was applied onto samples of AA 2024-T3 surface with zinc phosphate (ER-ZP) and without zinc phosphate (standard). Zinc phosphate was added to the formulation in about 5 wt%. The coated AA2024-T3 substrates were evaluated by exposing them to a salt spray test chamber for various periods of time. The anticorrosive performances of the two epoxy coatings, the standard (ER) and the one containing ZP (ER-ZP), were evaluated by electrochemical impedance spectroscopy (EIS). The surface morphology of the two coatings was characterized by a scanning electron microscopy and optical microscopy. The two coated AA2024 T3 samples were tested in a harsh environment of electrolyte solution to simulate the marine environment (3 wt% NaCl solution). The value of the impedance ($|Z|_{0.01 \text{ Hz}}$) obtained by the EIS method for the standard epoxy coating (ER) and epoxy coating containing ZP (ER-ZP) were 0.88 M Ω cm² and 6.92 M Ω cm² during the 2 h of immersion in 3 wt% NaCl, respectively. After exposure for a long period of time in salt spray test chamber (4392 h) and 2 h of immersion in 3 wt% NaCl the values were dropped to 0.27 M Ω cm² and 0.83 M Ω cm², respectively. Under these conditions, a very high impedance value was obtained for AA2024-T3 samples coated with an epoxy coating containing ZP (ER-ZP). The results showed that, the ER-ZP coating surface applied on AA2024-T3 samples exposed for 4392 h showed that, the coating is homogeneous and well adhered to aluminum alloy 2024-T3 surface. The results indicated that, ZP played a dual role, it enhanced the adhesion properties of the ER coating and the coating performance as an effective barrier. © 2018, Springer Nature Switzerland AG.

Author Keywords

AA2024-T3 and 3 wt% NaCl; Coating; Epoxy resin DGEBA; Polyaminoamide; Zinc phosphate