Effect of hydrothermal treatments with Ce (III) ions on the corrosion resistance of AA2524-T3 alloy anodized in TSA and protected with hybrid sol–gel coating

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Aircraft parts made of aluminum alloys are protected by organic coatings in order to avoid their exposure to the corrosive environment. Prior to organic coating, aluminum alloys are anodized usually by a process that generates toxic residues leading to environmental and health related problems [1,2]. Recently, chromium free anodizing processes have been proposed as viable alternatives to commercial chromic acid anodizing processes. The AA2524-T3 alloy was originally developed as a replacement for AA2024-T3. It presents high damage-tolerance and excellent fatigue properties. However, it also presents high susceptibility to localized corrosion, such as pitting corrosion and stress corrosion cracking.

In this study, AA2524-T3 specimens were anodized in a tartaric-sulfuric acid (TSA) bath, and then exposed to hydrothermal treatment in aqueous solutions containing cerium ions at the boiling temperature. Samples with hydrothermal treatment in boiling water were also prepared for comparison reasons. Subsequently to hydrothermal treatments, the samples were coated by a hybrid sol–gel coating. The sol–gel coating was prepared using a solution with high water content (58 %v/v) and was obtained by hydrolysis and condensation of TEOS and GPTMS. The corrosion resistance of both systems was evaluated in a NaCl solution by EIS as a function of immersion time. The EIS results showed that the addition of Ce(III) ions improved the corrosion resistance of the TSA anodized AA2524-T3 alloy with sol-gel coating. The EIS results were fitted and interpreted using electrical equivalent circuits.

Keywords: AA2524-T3, TSA, corrosion, Ce (III), sol-gel coating

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