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Hexafluorozirconic Acid-based Nanoceramic Conversion Coatings on AA3105 Aluminum Alloy: Influence of the Presence of Copper in the Deposition Bath

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Abstract

Surface pre-treatments are used to promote better adhesion of organic coatings and improve the corrosion protection of metals and alloys. The application of Zr-based conversion coatings by immersion in hexafluorozirconic acid has been introduced in various industrial applications, such as in the automotive industry. This work focused on the process of forming and characterizing Zr-based conversion coatings on the AA3105 aluminium alloy. The nanoceramic coating obtained in 3 g/L of H₂ZrF₆ (45%) for 60 s was evaluated by Raman spectroscopy. In addition, the effect of adding Cu²⁺ ions as a precursor of the nanoceramic coating was evaluated by electrochemical impedance spectroscopy and potentiodynamic polarization analysis in 0.1 M NaCl solution. The presence of metal oxides and hydroxides in the coating was identified on the metal surface. The nanoceramic coating provided a lower corrosion potential and reduced current densities compared to the as-polished sample. The presence of copper ions in the nanoceramic bath caused an increase in the potential and a reduction in the formation time of the coating. However, the reduction in the corrosion potential and polarization resistance, in addition to the increase in current densities in NaCl solution, demonstrated a reduction in the corrosion resistance of the nanoceramic coating formed in the presence of this precursor.

Keywords: Nanoceramic coating, Aluminium alloy, Hexafluorozirconic acid, Copper ions, Corrosion

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