

Chromate and HF free pretreatment for MAO/electroless nickel plating on AZ31B magnesium alloy

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Abstract

Microarc oxidation (MAO) coating was developed as an interlayer for the electroless nickel (EN) top coat to improve the corrosion resistance of Mg alloy. Prior to the electroless nickel coating, oxide layer was activated by using NaBH_4 solution as a replacement for traditional chromate and HF activation process. The EN coatings were prepared from the alkaline carbonate bath. The prepared coatings were characterized for the surface morphology and composition using Field emission scanning electron microscopy (FE-SEM) attached with Energy dispersive analysis of X-ray (EDX). Potentiodynamic polarization and electrochemical impedance spectroscopy (EIS) studies were carried out in non-deaerated 3.5% NaCl solution to find out the corrosion resistance of the coatings. The MAO coating showed porous morphology with micro cracks whereas, MAO/Ni-P coating exhibited dense nodular structure. The composition analysis on the surface of MAO/Ni-P showed 10 wt.% P indicated the high P coating. The cross-sectional images showed good adhesion between MAO and Ni-P layers. This clearly indicates that the present activation process results in dense with uniform pores of MAO coating which supply excellent bonding interface for Ni-P coat. The MAO/EN coating combination showed about 97 times improved corrosion resistance as compared with the substrate and similar behaviour was observed by EIS studies.

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