

Zinc Phosphating on Zinc-Nickel Coated Surface for Corrosion Resistance and Electropainting Enhancement

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This research is aimed at zinc phosphating on Zn-Ni coated low carbon steel surface for corrosion resistance and adhesion of electropainting improvement. Prior to electropainting, Zn-Ni alloys were coated on low carbon steel using acid bath. Two plating parameters, current density and pH, were studied (other plating parameters: temperature and coating thickness were controlled at room temperature and 10 μm ., respectively). Current density of 1 A/dm² and pH of 4.5 were the conditions that provided Zn-Ni alloys surface with 9.54 w.% Ni content and period of 368 hours after 5% red rust (salt spray test). The surface was then used for zinc phosphating.

For zinc phosphating, six parameters effected electropainting were types of metal ion (Zn, Ni, Mn) in plating bath, amount of Ni and Mn ions in the bath, concentration of phosphoric acid and sodium nitrate, and pH. The optimum coating conditions were Zn, Ni, Mn ions of 0.03, 0.02 and 0.04 mol/l, respectively, phosphoric acid of 20 g/l, sodium nitrate of 2 g/l, and pH of 2.5 (temperature was constant at 45 °C). The conditions yielded the greatest corrosion resistance of 493 hours (5% red rust observed).

In electropainting step, the conditions provided the greatest adhesion of paint (5A level, ASTM D3359) with 1506 hours corrosion resistance. The smaller the grain size of coated zinc phosphate surface, the better the adhesion of paint was. The presence of Ni and Mn ions in zinc phosphate solution significantly reduced grain size of the coated zinc phosphate surface which, in turn, enhance corrosion resistance.