

Mechanical and Chemical Properties of Zn-Ni-Al₂O₃ Nano Composite Coatings

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Abstract : Zn alloy and composite coatings are widely used in buildings and structures, automobile and fasteners industries to protect steel component from corrosion. In this paper, Zn-Ni-Al₂O₃ nano-composite coatings were electrodeposited on mild steel using a novel sol enhanced electroplating method. In this method, transparent Al₂O₃ sol was added into the acidic Zn-Ni bath to produced Zn-Ni-Al₂O₃ nano-composite coatings. The effect of alumina sol on the electrodeposition process, and coating properties was investigated using cyclic voltammetry, XRD, ESEM and Tafel test. Results from XRD tests showed that the structure of all coatings was single γ -Ni₅Zn₂₁ phase. Cyclic voltammetry results showed that the electrodeposition overpotential was lower in the presence of alumina sol in the bath, and caused the reduction potential of Zn-Ni to shift to more positive values. Zn-Ni-Al₂O₃ nano composite coatings produced more uniform and compact deposits, with fine grained microstructure when compared to Zn-Ni coatings. The corrosion resistance of Zn-Ni coatings was improved significantly by incorporation of alumina nano particles into the coatings.

Keywords : Zn-Ni-Al₂O₃ composite coatings, steel, sol-enhanced electroplating, corrosion resistance

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