Effect of Trimethylamine Borane (TMAB) on the Corrosion Resistance and Mechanical Properties of Nickel-Based Composite Coatings

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In this study, B₄C particles are added into “Ni bath” and “Ni-B bath” (added TMAB) to electrodeposited Ni/B₄C and Ni-B/B₄C composite coating, respectively. The purpose of this study is to understand the effects of adding TMAB to the nickel plating solution on the corrosion resistance and wear resistance of the Ni/B₄C and Ni-B/B₄C composite coating. The SEM images shows a looser structure occurred at Ni-B/B₄C composite coating. The i_{corr} value of Ni/B₄C and Ni-B/B₄C composite coating deposited on low carbon steel is 6.04×10^{-6} A/cm² and 1.06×10^{-4} A/cm², respectively. The reason of poor corrosion resistance of Ni-B/B₄C composite coating can be attributed to the addition of TMAB into Ni bath will change the Zeta potential of B₄C particles from 1.77 mV to -2.26 mV, and caused some reduced metal ions will preferentially deposited on the surface of particles when particles have a negative surface charge condition, the particles coated with metal ions on the surface will gather together and block the deposition of reduced metal ions on the cathode surface, finally formed a looser structure in Ni-B/B₄C composite coating. The adhesion strength of Ni-B/B₄C composite coating is approximately at 2.5 N, the adhesion strength of Ni/B₄C composite coating is approximately at 7.6 N, it indicates the looser microstructure will decrease the adhesion strength of composite Ni-B/B₄C coating.

Keywords: Ni/B₄C composite coating, Ni-B/B₄C composite coating, corrosion resistance, Zeta potential

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