Influence of Pulse Parameters on the Morphology and Corrosion Resistance of Nickel-Graphene Composite Coating

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Ni-graphene composite coatings were electrodeposited on mild steel substrate in Watt plating solution containing suspended graphene oxide (GO). Raman spectra confirmed the reduction of GO during the deposition process. Furthermore, effects of graphene concentration and electrodeposition parameters including current density, pulse frequency, and duty cycle were investigated by electrochemical tests and various characterization techniques. Morphology and anti-corrosion properties of the Ni-graphene coatings electrodeposited under different parameters were evaluated by scanning electron microscopy, potentiodynamic polarization, and electrochemical impedance spectroscopy. The results showed that the Ni-graphene composite coating, deposited at the GO concentration of $0.2 \text{ g}\cdot\text{L}^{-1}$, current density of $6 \text{ A}\cdot\text{dm}^{-2}$, frequency of 50 Hz, and duty cycle of 0.4, exhibited uniform morphology and dense structure. The corrosion current density of Ni-graphene coating prepared under optimal parameters is an order of magnitude smaller than that of pure Ni coating.

Keywords: nickel-graphene, composite coating, electrodeposition parameter, corrosion resistance

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