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Ni–TiN and Ni-Co-TiN Composite Coatings for Corrosion Protection: Fabrication and Electrochemical Characterization

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Abstract

The Ni coating is one of metal coatings that are commonly deposited by electrodeposition for corrosion inhibition. The addition of particles such as TiN and Co in the Ni coating modifies coating properties. In the present work, Ni–TiN and Ni-Co-TiN composite coatings with different amounts of TiN microparticles were prepared by using the electrodeposition technique. Different characterization methods including X-ray diffraction (XRD), scanning electron microscopy (SEM), Energy Dispersive X-ray analysis (EDX) and Vicker's microhardness tester were used to investigate the effects of adding cobalt and TiN microparticles on the surface morphology, grain size, and hardness of the Ni-TiN and Ni-Co-TiN composite coatings. The electrochemical corrosion behavior of the composite coating was evaluated by potentiodynamic polarization and electrochemical impedance spectroscopy (EIS) in NaCl solution. The addition of cobalt in the Ni–Co-TiN composite coating resulted in the grain size decrease (≈ 41.8nm) and hardness increase. The microstructure analysis showed that, the (111) planes were the close packed planes compared with the (200) planes. Thus, with adding Co and TiN particles the (200) texture changed to the (111) texture. The electrochemical analysis showed that, the anti-corrosion behavior of the Ni-Co-TiN composite coating significantly enhanced by adding Co and TiN particles.

Keywords Composite coating; Titanium nitride; Microhardness; Potentiodynamic polarization; Electrochemical impedance.