Mechanical and Electrochemical Behavior of Ni-W Alloy Coatings

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Pulse electro-co-deposition technique was employed to synthesize Ni-W alloy coatings by varying pulse frequency and current density. The deposition process was performed in the newly established deposition bath that does not contain surfactants and stress relieving agents. The Ni-W coated samples were evaluated to determine surface-mechanical (microhardness and wear) and electrochemical properties. Phase formation, microstructure, and compositional analysis of Ni-W alloy coatings were examined by XRD, SEM, and EDS, respectively. Microstructure examination revealed that morphology of the coating varied with pulsed frequency and current density. An increase in the current density at fixed pulse frequency improved the surface mechanical properties (hardness and wear properties) owing to higher W content, fine, and dense structure of the coating. The maximum hardness (920 HV) and wear resistance were observed in the Ni-W coating that was obtained at the current density of 60 mA.cm-2 and frequency of 2 kHz. Electrochemical polarization test and EIS study carried out in 3.5 wt.% NaCl solution reveal that a decrease in corrosion resistance of the coating is due to finer morphology or strained matrix; whereas, higher W content improves the corrosion resistance.

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