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Influence of Heat Treatment on Microstructure and Mechanical Properties of Pulse Electrodeposited Ni-W Alloy Coatings

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Abstract

The present study deals with the electrodeposition and structural characterization of as-deposited and heat treated nickel-tungsten (Ni-W) alloy coatings. The coatings were deposited using pulse reverse electrodeposition (PRED) and pulse electrodeposition (PED) from a Ni-W plating bath. Wide range of alloy compositions have been obtained with tungsten(W) percentage in the alloy ranging from 0% to 25 at% by altering pulse parameters. The coatings were subsequently heat treated at a temperature of 700 ^{o}C for 1 h and were characterized in terms of phases present, grain size, hardness and elastic modulus. It was observed that the coatings were crystalline up to 12 at% W and beyond which the coatings were found to be a mixture of amorphous and crystalline phases. Heat treatment resulted in crystallization of amorphous phase and precipitation of secondary phases. Substantial grain growth had occurred after heat treatment and as a result, the hardness of heat treated coatings was found to be less than that of their as-deposited counterparts up to 17 at% W. Beyond 17 at% W hardness of heat treated Ni-W was found to be higher due to dispersion hardening.

Keywords: Electrodeposition; Heat treatment; Ni-W alloys; Nano-Crystalline alloys; Hardness; Elastic modulus