Influence of Pulse Operational Parameters on Electrodeposition, Morphology and Microstructure of Ni/nanodiamond Composite Coatings

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Nickel and Nickel-nanodiamond coatings have been successfully electrodeposited on copper substrates by the pulse plating method. The variables investigated within this work include the current density, pulse frequency, bath temperature, duty cycle and nanodiamond concentration of the bath. Pure nickel coatings possess a preferred orientation along (111) crystal plane, however incorporation of the nanodiamond particulates in the platings increases the relative peak intensity corresponding to (200) crystal plane. It was found that presence of nanoparticles on the cathode surface leads to the formation of large nickel grains with [100] preferred orientation and small grains with [111] preferred orientation. X-ray diffraction studies demonstrated that incorporation of nanodiamond particulates to the nickel matrix causes negative lattice distortions in the nickel matrix. Presence of the nanodiamond particulates slightly decreases the current efficiency and deposition rate. Incorporation rate of nanodiamond particulates increases with decreasing current density and increasing pulse frequency. Maximum incorporation rate of 2.24 Vol.% was achieved at the duty cycle of 25%.

Keywords: Electrodeposition; Nanocomposite; Nanodiamond; Nickel; Microstructure; Morphology.

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