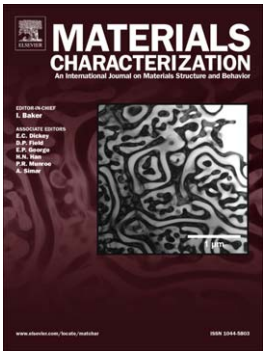

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Experimental Investigation of Grain Boundaries Misorientations and Nano Twinning Induced Strengthening on addition of Silicon Carbide in Pulse Electrodeposited Nickel Tungsten Composite Coating

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Abstract

Nanoindentation was performed on silicon carbide (SiC) reinforced pulse electrodeposited nickel-tungsten (Ni-W) composite coating. Addition of 5 vol. % of SiC in Ni-W coating increased the hardness from 10.31±0.65 GPa to 14.32±0.63 GPa and elastic modulus from 119.74±3.15 GPa to 139.26±2.09 GPa. Increased hardness and elastic modulus directly translates to the improved strengthening in the coating. An experimental investigation of strengthening mechanism was carried out in Ni-W-5 vol. % SiC alloy. Two simultaneous phenomena viz. grain refinement and increased internal strain was observed, which increased the dislocation density from 5.51×10^{18} m^{-2} to 1.346×10^{19} m^{-2} on reinforcement of 5 vol. % of SiC in Ni-W coating. Increased dislocation density promoted the formation of grain boundary misorientations and nano twinning. Low angle grain boundary, high angle grain boundary and nano twinning were identified using high resolution transmission electron microscope (HR-TEM) image and their role in strengthening mechanism was discussed in details.

Keywords: Pulse Electrodeposition, Nickel alloy, Nanoindentation, High resolution transmission electron microscope, Grain boundaries Misorientations, Nano Twinning.

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