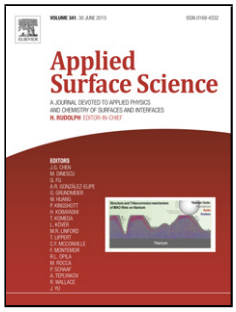

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Microstructural, Phase Evolution and Corrosion Properties of Silicon Carbide Reinforced Pulse Electrodeposited Nickel-Tungsten Composite Coatings

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Abstract

Silicon carbide (SiC) reinforced Nickel-Tungsten (Ni-W) coatings were successfully fabricated on steel substrate by pulse electrodeposition method (PED) and the amount of SiC was varied as 0g/l, 2g/l, and 5g/l in Ni-W coating. Effect of subsequent addition of SiC on microstructures, phases and on corrosion property of the coating was investigated. Field emission scanning electron microscopy (FE-SEM) image of the surface morphology of the coating showed the transformation from the dome like structure to turtle shell like structure. X-ray diffraction (XRD) of Ni-W-5g/l SiC showed the disappearance of (220) plane of Ni(W), peak splitting in major peak of Ni(W) and formation of distinct peak of W(Ni) solid solution. Absence of (220) plane, peak splitting and presence of W(Ni) solid solution was explained by the high resolution transmission electron microscopy (HR-TEM) images. Tafel polarization plot was used to study the corrosion property of the coatings in 0.5M NaCl solution. Ni-W-5g/l SiC coating was showed higher corrosion resistance (i.e. ~21% increase in corrosion potential, E_{corr}) compared to Ni-W coating. Two simultaneous phenomena have been identified for the enhanced corrosion resistance of Ni-W-5g/l SiC coating. (a) Presence of crystallographic texture (b) formation of continuous double barrier layer of $NiWO_4$ and SiO_2.

Keywords: Pulse Electrodeposition, Nickel-Tungsten alloy, Silicon Carbide, Surface morphology, Phase Evolution, Corrosion

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