Design and Properties of Ni-TiN/SiC Nanocoatings Prepared by Pulse Current Electrodeposition

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Ni-TiN/SiC nanocoatings were fabricated using pulse current electrodeposition (PCE) technique. The influence of plating parameters on morphology, microstructure, microhardness, and wear behavior of the resulting coatings were investigated by instrumental techniques such as transmission electron microscopy (TEM), scanning electron microscopy (SEM), X-ray diffraction (XRD) and X-ray photoelectron spectroscopy (XPS) as well as by tribological, abrasion and electrochemical testing. Test results confirmed incorporation of numerous TiN and SiC nanoparticles (with 45.9 and 37.2 nm average sizes, respectively) into the coating prepared at 4 A/dm² pulse current density. Cross-sectional views of this nanocoating revealed high concentrations of Ti (19.6 at%), Si (12.1 at%), and Ni (53.3 at%). Microhardness of this Ni-TiN/SiC nanocoating was 848.1 Hv, which is significantly higher comparing to other coatings prepared in this work. The wear rate of Ni-TiN/SiC nanocoating prepared at 4 A/dm² was only 13.6 mg/min, and only some small surface scratches were observed. Both of these results indicate outstanding wear resistance and performance of our novel Ni-TiN/SiC nanocoatings. In addition, Ni-TiN/SiC nanocoating deposited at 4 A/dm² had the smallest corrosion current density equal to 8.12×10⁻⁶ A/cm², which indicates the best corrosion resistance.

Keywords: Ni-TiN/SiC nanocoating; pulse current electrodeposition; microstructure; microhardness; wear resistance

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