Ultrasonic electrochemical deposition and characterization of Ni-SiC nanocomposite coatings

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Abstract:

Nickel-ceramics nanocomposite coatings can be applied as the wear resistance coating, corrosion protection of underlying materials, and decorative coatings. Hence, Nickel based nanocomposite coatings, especially Ni-SiC, have been extensively studied in recent years. However, more often agglomeration problem of the nanoparticles in the nickel matrix can cause deterioration of the mechanical properties rather than improvement. The homogeneous distribution of the nanoparticles in the matrix coating is still being challenging. In this experiment, electrochemical deposition of Ni-SiC composite coating was done in presence of ultrasound. The effects of different ultrasonic powers and frequencies on the nanoparticle dispersion were studied. The electrodeposition was carried out in nickel sulfamate bath by applying pulse current technique. Compared to the conventional mechanical stirring technique to prevent nanoparticles agglomeration and sedimentation during composite electrodeposition, the aid of ultrasonic dispersion along with mechanical stirring has been found to be more effective not only for the nanoparticles dispersion, but also for the mechanical properties of the electrodeposited coatings. Nanoparticles were found to be distributed homogeneously with reduced agglomeration. The microstructure of the composite coating has also been changed, allowing some random orientations of the nickel crystallite grain growths, smooth surface, and finer grains. As a consequence, better mechanical properties of the composites were observed.

Keywords: Composite coatings, Pulse ultrasonic electrodepositon, Microhardness

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