TRIBOLOGICAL BEHAVIOR OF NANOSTRUCTURED NICKEL

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ABSTRACT

The present study reports the effects of electroplating parameters on the microstructure, and thus the mechanical and tribological properties, of nanostructured nickel. Electroplating was conducted in a Watt's type bath at current densities of 30 mA/cm^2 and 15 mA/cm^2 in electroplating bath temperatures of 30°C and 50°C. The PH of the bath was maintained at 3.0 using sulfuric acid. The electroplating was carried out using a direct current in galvanostatic mode with a nickel anode contained in a titanium wire basket. Average grain sizes and uniformity of grains were determined from TEM and SEM micrographs. Tribological tests were carried out on a pin-on-disc type tribometer. The same tests were conducted on Ni-200 for the purpose of comparison. Wear rates were calculated for the nickel surfaces using optical profilometry and for the alumina pins using optical microscopy. Nano-indention techniques provided the nanohardness, stiffness, and reduced modulus values for all samples. Microhardness readings were also recorded to further study the surface properties. Results show how grain size, mechanical properties, and wear properties change with the variations in plating parameters. Grain size reduction shows surface hardness increases and improved tribological properties. Plating bath temperature increases showed a decrease in grain uniformity.

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