A Study on the Corrosion and Wear Behavior of Nanocrystalline Ni-W-P Electrodeposited Coatings

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ABSTRACT

In this thesis, a block-on-ring tribocorrosion tester was employed to study the corrosion and wear behavior of electrodeposited Ni-W-P alloy in 5% NaCl solution. Under different polarization overpotentials, the effects of coating microstructure on the weight loss and friction coefficient were investigated quantitatively. In corrosion testing, the coating surface started from good corrosion resistant to the initiation of tiny corrosion pits with the increasing polarization potential. Eventually, the growth and interconnection between pitting holes induced cracking and increased the weight loss and surface roughness. For tribocorrosion under the application of very low overpotential, the surface showed trace of wear but no corrosion. Accompanying the raise in overpotential, the area of wear contact as well as the coefficient of friction increased. At high overpotential, pitting holes emerged in addition to the wearing trace on the surface. Finally, the enlargement of the area and depth of pitting holes rendered the initiation of cracking. However, the enlarged pitting holes provided the sites for the inclusion of solution between the coating and the wear block, which assumed the load bearing capability and reduced the area of contact. Subsequently, the coefficient of friction decreased with the increase in overpotential. In quantitative tribocorrosion analysis, Ni-W-P alloy was found to have good wear-corrosion resistance at low overpotentials. Under the application of high overpotential, the synergistic effect between wear and corrosion was the main cause for the quick deterioration of the coating surface. In addition, the wear weight loss increased continuously with the raise in overpotential while the corrosion weight loss remained more or less constant.

Keywords : Electrodeposited Ni-W-P alloy、wear、corrosion、tribocorrosion

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