

Tribo-corrosion behaviour of electrodeposited Nickel based composite coatings

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Abstract:

Electrodeposition is one of the most technologically feasible and economically superior techniques for producing metal matrix composite coatings. Particle-reinforced metal matrix composites (MMCs) generally exhibited wide engineering applications due to their enhanced hardness, better wear, and corrosion resistance when compared to pure metal or alloy. In the present study, nickel composite coatings (Ni-SiC, Ni-YSZ, and Ni-ZrO₂) were successfully synthesized from nickel sulphamate electrolyte containing ceramic particles like SiC, YSZ and ZrO₂ by direct current (DC) plating with the aid of mechanical and magnetic agitation. The effect of magnetic and mechanical agitation on microstructure, mechanical, and tribological properties have been analyzed. It was observed from the studies that mechanical properties obtained by adopting mechanical agitation were better compared to those of the coatings obtained using magnetic agitation.

The FESEM studies revealed that in Ni-SiC composite the SiC particles were covered by a film of nickel while, in the oxide reinforced composite coatings the oxide particles were distinctly visible on the surface of coatings. Tribological testing of the composite coatings under dry sliding conditions and under wet conditions (distilled water) was carried out. The tribological studies under dry sliding conditions showed that the wear loss was less for Ni-YSZ coating compared to the other Ni composite coatings. However, in distilled water medium Ni-SiC coating exhibited better wear resistance than the other coatings. The corrosion behaviour was evaluated using polarization and electrochemical impedance studies. The studies showed that oxide particle reinforced Ni composites possess better corrosion resistance due to their lower I_{corr} when compared with the Ni-SiC coating. Tribo-corrosion studies were carried out to understand the synergistic effect of wear and corrosion on the performance of Ni based composite coatings in 0.5M Na₂SO₄. Among various composite coatings Ni-YSZ exhibited less material loss thereby showing better tribo-corrosion behavior.

Keywords: Metal matrix composites, agitation, tribological behavior, polarization and electrochemical impedance, tribo-corrosion.
