Thesis Title	A Study of Nickel-Alumina Electrodeposited Composite Coatings
Thesis Credits	15
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Degree of Study	Master of Engineering
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Academic Year	1999

Abstract

Electrodeposited composite coating is the process that reinforcements, e.g.ceramics, in the electrolyte are deposited with metal matrix during electrochemical reaction, lead to better properties of the film in higher value of hardness and wear resistance.

A Conventional Electrocodeposition (CECD) technique is used in this investigation to prepare nickel-alumina ($Ni\text{-}Al_2O_3$) electrodeposited composite coating and to study the effects of these process parameters: particles size of alumina (0.3, 0.1μm), particles concentration in solution (0.5, 1.5, 5.0 g/l), and current density (2.5, 3.5, 4.5 A/dm^2), respectively. This composite coating is done on low carbon steel plates of 10×10 cm^2 and formerly coated with dull nickel.

Experimental results showed that $Ni\text{-}Al_2O_3$ film had higher value of hardness (500-600 Hv) than pure Ni film (250Hv) and the cathode efficiency of $Ni\text{-}Al_2O_3$ films (57-60%) is lower than pure Ni films (65-68%) due to the influence of polarization during deposition.

The wear resistance of composite coating was better than pure Ni film and depended on the quantity and distribution of alumina powders in the film. It was found that, the amount of alumina powders from 0.05 to 0.35 percent by weight could reduce wear rate by 30 to 40 percent compare to the wear rate in pure Ni film, and was also found that, too high particle concentration in solution reduced the amount of alumina particles in composite film due to paricle collisions under the influence of pumping circulation. When the alumina particles were very small (0.3 μm), these were particle coagulation deposite in Ni matrix, this coagulation with loosely Ni matrix binder in between particles result in very low wear resistance of the film. Moreover, when the particle concentration in solution increase, the surface roughness of composite $Ni\text{-}Al_2O_3$ film will increase due to higher current density that reduced wear resistance of the film.

Keywords : Electrodeposited composite coating / hardness / wear resistance / alumina powders / dull nickel / pure nickel / surface roughness