

Evaluation of Electroless Nickel-Phosphorus (EN) coatings

The utilization of Electroless Nickel-Phosphorus (EN) coatings has witnessed a staggering increase during the last two decades. Many outstanding characteristics of the EN coating method have generated a lot of interest in various industries including oil and gas, electronic, chemical, automotive, aerospace, and mining. Some of the highlighted characteristics of EN coatings are superior corrosion and wear resistance especially in environments containing H_2S and CO_2 , superior mechanical properties, uniform coating thickness, excellent surface finish properties, superb adhesion characteristics, and wide range of thickness.

The EN coating process is based on a redox reaction in which a reducing agent is oxidized and Ni^{+2} ions are reduced on the surface of the substrate materials. Once the first layer of Ni is deposited, it acts as a catalyst for the process. Consequently, a linear relationship between coating thickness and time usually occurs. If the reducing agent is sodium hypophosphite, the deposit obtained will be a nickel-phosphorus alloy.

The objective of this talk is to evaluate various properties, mechanical, physical, electrochemical and microstructural, of three types of EN coatings, namely, low, medium, and high phosphorus. Also, the effects of various coating parameters including coating thickness and phosphorus content on properties of EN coatings were comprehensively investigated. Furthermore, the effect of post heat treatment on various properties of EN coatings was studied. Heat treatment on EN deposits in the range of 300-400 °C for one hour caused the hardness to increase due to the formation of various types of nickel phosphide (Ni_xP_y).