

ADVANCES IN MATERIALS ENGINEERING

Volume 1

Edited By:
Zahurin Halim
Iskandar Idris Yaacob
Md Abdul Maleque



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Electroless Nickel Based Coatings From Solution Containing Sodium Hypophosphite

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Abstract. Electroless deposition is a valuable technique to deposit coatings with excellent thickness, wear and corrosion resistance. This technique can coat not only metallic materials but also non metallic materials such as plastics and rubber. Coatings can be tailored by selecting the composition of the coating alloy to suit specific requirements. The application of these coatings is expanding fast. In the present chapter, an attempt has been made to discuss electroless coatings with respect to bath containing sodium hypophosphite, coating composition and properties. Discussion also extended to the characteristic of various electroless nickel-based coatings after heat treated at various temperatures.

Introduction

Electroless coating is a method of depositing metals or alloys by using chemical energy within the materials, known as a autocatalytic reduction method. By the controlled chemical reduction reaction, the electroless coating has emerged as one of the important method in surface engineering and metal finishing. Electroless coating has unique physicochemical and mechanical properties for which they are being used increasingly.

The advantage of using the autocatalytic reduction reaction is in maintaining overall uniformity of coating in composition and thickness which is independent of the thickness variations of the substrate. The other valuable properties are: excellent corrosion resistance, very good wear and abrasion resistance, high hardness, nanocrystalline and low coefficient of friction. Most applications of the electroless coating are based on their wear and corrosion resistance. However, the characteristic like high hardness and low coefficient of friction have a great potential in daily life applications.

Different alloys are coated for desired physical and mechanical properties. Several binary and ternary alloys have been deposited such as Ni-P [1], Ni-B [2], Co-P, Co-B [3], Ni-Co-P [4], Ni-W-P [5], and Fe-Sn-B, Fe-W-B, Fe-Mo-B [6]. Nickel turns out to be the single most widely coated element with phosphorous. Apart from nickel, many alloys contain at least one of the elements Co, Fe, Cu, and Au.

Deposition. Electroless alloy coatings are produced by the controlled chemical reduction of metallic ions onto a surface and the reaction continues as long as the surface remains in contact with the bath solution. The coating is uniform throughout the surface of the substrate. Therefore, all parts of the surface area of substrate which are equally immersed in the bath have equal probability of getting alloy deposited.

Two types of baths have been used for depositing alloys: acidic and alkaline baths. The bath characteristics have been considered by taking nickel as an example. A source of nickel ions, usually nickel sulphate or nickel chloride is used. The electroless bath solution comprises of different chemicals each performing an important function as below: a reducing agent to supply electrons for the reduction of nickel, complexing agents to control the free nickel available to the