



Electroless Nickel Plating WHAT IS ELECTROLESS NICKEL?

This volume is concerned with autocatalytic nickel plating, commonly referred to as electroless nickel plating. In contrast with electroplating, electroless nickel (EN) plating does not require rectifiers, electrical current or anodes. Deposition occurs in an aqueous solution containing metal ions a reducing agent, chelates, complexing agents and stabilizers. Chemical reactions on the surface of the part being plated cause deposition of a nickel alloy.

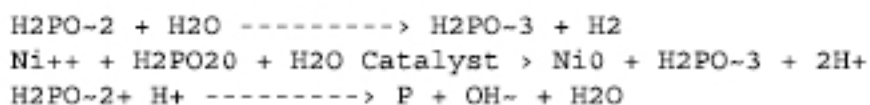
Since all surfaces wetted by the electroless nickel solution are plated, the deposit thickness is quite uniform. This unique property of EN makes it possible to coat internal surfaces of pipes, valves and other parts. Such uniformity of deposit thickness is difficult, if not impossible, to achieve by any other method.

The discovery of electroless plating is credited to Brenner & Riddell in the 1940's. Today EN has grown into a very substantial segment of the metal products finishing industry.

Compared with plating of other metals, electroless nickel (EN) plating is relatively young being commercially available for less than 30 years; however, in the past decade the usage of the coating has grown to such proportions that electroless nickel plated parts are found underground, in outer space, and in a myriad of areas in between.

This guide seeks to provide the reader with more thorough understanding of the process. The volume includes descriptions of deposit properties, equipment required, process applicability and test procedures to the end that a high quality EN deposit can be achieved and maintained.

The chemical reactions that occur when using sodium hypophosphite as the reducing agent in electroless nickel plating are as follows:



An electroless nickel coating is a dense alloy of nickel and phosphorus. The amount of phosphorus codeposited can range from less than 1% to 12%, depending upon bath formulation, operating pH and bath age. The deposition process is autocatalytic; i.e., once a primary layer of nickel has formed on the substrate, that layer and each subsequent layer become the catalyst that causes the above reaction to continue. Thus, very thick coatings can be applied, provided that the ingredients in the plating bath are replenished in an orderly manner. In general commercial practice, thicknesses range from 0.1 mil to 5 mils but in some salvage operations 30 mil deposits are not uncommon.

Electroless nickel deposits are functional coatings and are rarely used for decorative purposes only. The primary criteria for using electroless nickel generally falls within the following categories:

- 1) Corrosion resistance.
- 2) Wear resistance.
- 3) Hardness.