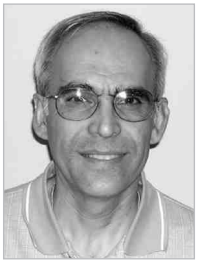
Finisher's Think Tank



Stephen F. Rudy, CEF
Enequist Chemical Co.
100 Varick Avenue
Brooklyn, NY 11237
718/497-1200
E-mail: sfrudy@aol.com

Nickel—It's Expensive, But In Demand

The past few years have been an unbelievable witness to the meteoric rise in the price of nickel metal and related salts. Anodes have risen in cost by over 600 percent! What's the bottom line to all this? Quite frankly, it usually revolves around price increases to maintain the cost of doing business, while factoring in profit margins that may be slim to almost none.

Two important facts remain in focus. Nickel plating is expensive to the finisher and customer, yet remains in practical demand. For several decades, nickel plating and its electroless counterpart (EN), have been unsurpassed in specific metal finishing cycles. These include decorative, engineering, aerospace, automotive, medical, construction, military, and a wide variety of consumer goods and appliances. Many specifications cover the use of nickel for such purposes as corrosion resistance, hardness, ductility, reflectance, and undercoat for chrome and brass.

The cost of nickel may be "going through the roof," but the varied demands for it in metal finishing remain hot. How to improve process efficiency and cost, while remaining competitive, is a key to success. It is not just important to follow the daily price of nickel on the international metals market. Going back to basics and adhering to a logical plan of action related to nickel deposition goes a long way to stimulate the bottom line. Lets review some helpful facts, that are presented free of charge.

The Job

Both finisher and customer must confirm the basis for any project or plating order. It applies equally from a simple shiny bright finish to strict engineering tolerances. The specifications should be clear with regard to end product, and the steps involved to achieve it. Production requirements should be balanced between the finisher's operating capability and the customer's on going needs. This is the time to determine if equipment requirements are sufficient or need upgrading. If the job is big enough and of sufficient duration (perhaps on-going), the customer may invest in and support the upgrades. The job keeps the finisher and his suppliers in business. Therefore, the supplier is an excellent source of practical information and assistance. Keep your supplier in the loop.

The Parts

This covers a wide scope. The parts would normally be intended for rack or barrel processing. Other methods, such as reel-to-reel, may also come into play. Fixturing on racks should retain integrity for contact points, maintain adequate rigidity, minimize shading or thieving, and promote drainage. A sufficient quantity of parts per rack or flight bar are needed to meet anticipated production goals. Barrel load sizes should meet production needs, while allowing for proper current distribution inside the barrel and rotation of parts without nesting. Barrel perforations should allow for sufficient solution throughput, while retaining the parts inside.

Anodes

The primary source of nickel in the plating bath is the anodes. Sulfur and non-sulfur types are used. Anode surface area should be around a ratio of 2:1 compared to surface area of parts being plated. The anode shapes include spears, cut squares, and round buttons. Baskets should be filled with the anodes. Regularly check to ensure that anodes are settling evenly, without any gaps in the baskets. Bagging the anodes in rack baths is important to prevent pitting and roughness of the plated deposit.

Plating Salts

Nickel-chloride, nickel-sulfate, and nickel-sulfamate are available in dry salts and liquid concentrates. Electrolytic pure grade is recommended. Boric acid quality standards should also meet those for plating.

Plating Additives

The organic concentrates used in blending brighteners, leveling agents and wetters are synthesized using techniques ensuring very high quality and purity.

Conditioning

This is composed of solution, mechanical, and electrical. Each can be reviewed separately.

Solution

Here the focus is on the nickel solution. The wet analysis confirms the need for any additions or adjustments. Plating tests, such as hull cell, determine properties of the nickel deposit (brightness, leveling, ductility, smoothness). Inspection of the deposit also indicates if any contaminants (metallic or organic) are present and reveals their magnitudes. Appropriate treatments or purification procedures can be determined and implemented. Suppliers offer in-house lab expertise and on-site technical service to help with solution analysis and maintenance. Their understanding of products and additives helps to determine what is best and at what levels for the nickel bath.

Mechanical

Many plating lines exhibit some degree of automation. This is made possible by critical information programmed into a computer. It should be reviewed and updatedor modified to meet the specific demands and parameters of the individual plating jobs. Plating lines are composed of overhead carriers, cranes, and transfer points that should receive proper maintenance and service. Tanks are only as good and serviceable as their integrity.

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Where installed, liners may need replacement, because of cracking or warping. Heating may be in the form of steam, or electrical. Check to insure steam lines are intact and provide adequate pressure. Electric heaters should be intact and operating efficiently. Above all, malfunctioning thermostats must be replaced. Filters are meant to efficiently circulate the plating solution, while removing particles and organic contaminants. Check the manufacturers recommendations for proper service and loading of carbon and filter aid. Warped plating barrels mean loose doors, through which the parts drop out. Defective barrels will flip up and down in the saddle, thus making and breaking contact. Heavily plated danglers aren't of much use. Built up rack tips reduce effective contact and result in burn and non-plate marks on parts. Cut or ripped rack insulation holds various solutions that inevitably contaminate the nickel bath.

Electrical

The right amount of "juice" makes a world of difference. Rectifiers carry the load. Serviced and maintained properly, they will accurately do so. This includes use of an oscilloscope to check for AC current. Contacts and connections should be cleaned and, where appropriate, lubricated. Hot cables signal trouble in the form of loose connections or undersized wiring. Automatic return type cycle master machines should be checked for any dead stations in the plating tank. This usually results in a bipolar condition that results in deposit haze. Don't take service work for granted. Always trace back cables and bussing to the correct rectifier anode and cathode connections, if it was initially necessary to disconnect them.

Reality & Faraday's Law

Over the years, I have been witness to countless attempts at violating Faraday's Law. The formal definition of Faraday's Law states: the mass of a substance produced at an electrode is proportional to the amount of electricity transferred at the electrode and to the gram-equivalent mass of substance. For us in traditional plating, it means that deposit thickness is proportional to the plating current density over time. There is no way to cut corners. A stated scientific law cannot be violated. The right procedure is to calculate the total surface area to be plated. Next, determine the plating time based on the data given for deposition of that metal (in this case nickel). This information is commonly found in metal finishing handbooks in tables of electrochemical equivalents and thickness of electrodeposits. In this way, not too little or not too much is deposited, but only what is specified.

Surface Preparation

Nickel plating and EN are very unforgiving if the surface has not been sufficiently cleaned and activated. Miss-plates, hazes, dullness, and brittleness are some of the unwelcome conditions that may occur. Every process tank and rinse in this part of the line should be maintained and serviced as required. It helps that the correct or most effective chemistries and operating parameters are being used.

The basis of this review is to highlight important and critical areas related to insuring successful nickel plating and EN. Every job has a cost in chemicals, man hours, production, and waste treatment associated with it. Rejects will almost always triple the total expense to re-plate them. That is, if the parts can be salvaged. Plating nickel at such a high metal cost and for naught! It couldn't get any worse. There is essentially no room or free board to repeat a job and still be profitable. Doing it right the first time keeps anticipated expenses to a realistic figure, probably in line with how the cost of doing the job was initially calculated. This in turn meets the anticipated profit margin. We arrive at a simple, but powerful statement: "An ounce of prevention is worth a pound of cure." ***P&SF***