Electrolytic Rack Stripping

Ralph V. Dixon
MacDermid Incorporated
245 Freight Street
Waterbury, Connecticut 06702

There are many ways to remove nickel from rack tips. You may use a hammer, vice-grips, or just twist with a pair of pliers. However there is the 21st Century method, electrolytic stripping removes nickel and copper deposits on every cycle, without destroying the rack tips or coating. We will discuss racks and rack stripping.

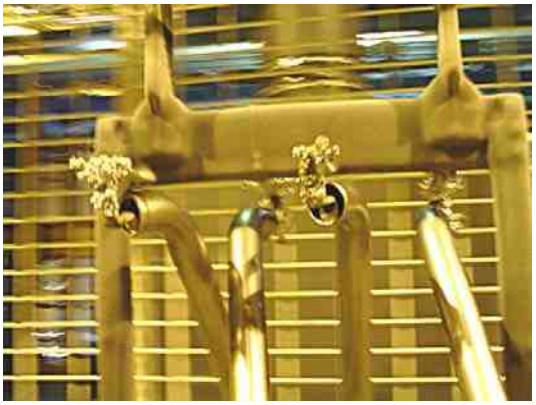
For more information, contact:
Ralph V. Dixon
MacDermid Incorporated
245 Freight Street
Waterbury, Connecticut 06702

There are many ways to remove nickel from rack tips. Typically you will see hammers, vice-grips or just twisting away at the tip with a pair of pliers. However, there is the 21st Century method, “Electrolytic Stripping”. Electrolytic stripping deplates nickel from the tip with no damage to the tip or the plastisol coating. Electro-stripping may be incorporated on automatic machines where racks are stripped on every cycle.

Typical method of rack stripping

Plating racks are the most expensive tooling we find in the shop; they are also the most abused item in the shop. The cost of an average rack for a full automatic plating machine can cost into thousands of dollars.

Walk through any plating shop and you will find racks stacked against the walls, hanging from overhead pipes, and being jockeyed from one area to another on their support splines, with little regard to the coating on the ends.



Costly rack tip nickel build-up

Poor rack maintenance accounts for many pounds of nickel metal being discarded, and sold at scrap prices, or just disposed of. Faulty tips and breaks in the plastisol coating, that are allowed to cycle through the plating bath, may plate out as much nickel as the work itself. Each cycle the surface area of the nubbin increases, acting as a thief, robbing current from the work. This can lead to dull low current density areas, thinner deposits, and chromium miss-plates. As these damaged tips grow in size, parts may fail to fit, then we find the rack cycling, only partially loaded. When a rack tip becomes unusable, it should be removed from the rack, and not allowed to cycle through the machine empty.

Rack Construction

Today we find more racks designed for ease of loading and unloading and not adhering to the principles electroplating practices. The standard practice is constructing a universal fixture that will plate any part that comes down the pike. The first rule is to design a rack for the part, second, don't let production interfere with proper design. Rack splines should be made of sufficiently sized solid copper. Connections are riveted and silver soldered to maintain solid contact, to assure proper current flow and capacity. Current carrying capacity for copper is 1000 amperes per in^2. There are those who have tried to replace the copper splines or cross members with steel or aluminum, these are not suitable materials, the results end up as substandard plating. Contact tips may be made of phosphorus bronze, copper or stainless steel. (*Electrolytic stripping requires 316 Stainless Steel)*.

Rack Coatings

The standard material for rack coating is Plastisol, (*polyvinyl chloride)* this is an area where you should not try to economize. Coatings that are too thin may break down, creating pinholes that allow contact with the spline, that will build up with nickel, creating misplates. Plastisol coatings are easily damaged; care must be taken in rack handling. When manually removing plated nickel from tips, damage will occur to the coating surrounding the tip, again creating an area for nickel to build-up.

Electrolytic Rack Stripping

We have already discussed the merits of manual stripping. Other methods available include, nitric acid and immersion strippers. Nitric acid needs little explanation as to its attributes. Immersion strippers start out great, as nickel content builds in the bath, the rate of metal removal decreases, until total

capacity of nickel is reached, at that point they are dumped and made up new. The above stripping is done off line; there are installations where immersion stripping is incorporated into the plating cycle. They proved to be costly to maintain and perform poorly.

Stripping racks electrolytically is ideally suited for automation, fitting neatly into automatic plating machines. These systems operate with the racks never leaving the plating conveyor. Rack storage may be part of the conveyor system. Software is available to identify individual racks and locate them in the system.
On automatic plating machines the racks are off loaded to a conveyor, moved to the un-racking area, then conveyed back to the plating machine and into the strip process, rinsed and off loaded and conveyed to the racking area to start the cycle anew.

Electrolytic stripping requires that the rack is stripped at least every two cycles on the machine, it is preferable that they are stripped on every cycle. Large nubbins of nickel are not removed electrolytically; conditions allowing these to occur must be corrected. The process has the ability to undercut the chromium, physically removing it. Required rack tip material is Type 316 stainless steel. When the bath is properly maintained, there is no attack on the rack tip material.

Stripping Process

Designed to dissolve and remove nickel, copper and other plated metal electrochemically from type 316 stainless steel, electrolytic rack strippers are mildly acidic solutions operating in a pH range of 6.0 to 7.0. Being regenerative, additions may be made by feeder pumps, with ampere-hour control. Stripped metals continuously precipitate as sludge and may be removed using a filter press.

Equipment

Tank …….Steel, Koroseal lined, PVC or fiberglass reinforced self supporting Atlac383 resin

Heating Coils ……. Type 316 SS, Titanium or quartz

DC Power ……. 12 volts (less than 15% ripple)

Cathodes …… Type 316SS, 304, 301 or 302 Stainless Steel. Cathode should be same length as work

Operating Conditions

Anode current density …… …….. 500 ASF (50 amp/dm)
Rack tip is anode
Voltage …… 6 to 12

Cathode to Anode Ratio …… 4:1

Rate……. 0.4 - 0.5 mil/min.
10 -12 µ/min.
pH ……...…… 6.0 to 7.0

Temperature …….. 100 to 140 F (38 to 60 C

Make-up

Bath is a two-part make-up

Additive A ……..…….. 20%

Additive B ……..…… 5%

Water ……..…… 75%

Solution Control

Make-up …….. 16 - 19 units

Activator ……..…… 10 - 12 units

Maintenance ……...….. 8 - 12 units

Additive A - 4 liters 2,500 amp hrs.

Additive B - 4 liters 11,000 amp hrs.

Additives may be controlled by chemical analysis.

Automation

The process may be installed into automatic plating lines, and should always be considered when investing in new equipment. On return type automatic plating machines it is difficult to incorporate on existing equipment. Plated racks are transferred by conveyor to the unload area, un-racked, then conveyed back to the plating machine, stripped, then conveyed to rack area for re-racking.

On programmed hoist the strip tank would be installed prior to the final hot water rinse. After un-racking the hoist would deliver the racks to the strip tank, stripped and moved to rack area. There are installations where the rack stripper is installed on a separate automatic machine, operating side by side with the plating machine.

Summary

Plating racks are expensive; they require special handling if they are to last. Plating racks should always have a designated proper storage area. They are a main factor in producing high quality work, and have a direct affect on reject rates. Electrolytic rack strippers will assure that rack tips are always clean, offering proper contact of parts. They have proven themselves in the field in numerous plating facilities, and offer the following:

1. Extended rack life.
2. Improved deposit distribution.
3. Reduction in lost nickel being plated out on racks.
4. Improved part to rack fit.
5. Waste treatment reduction.
6. Less equipment corrosion.
7. Safer working conditions.