Finishers' Think Tank



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New Year/New Challenges

The new year brings with it new challenges to the metal finishing industry. Among these challenges are:

- Maintaining and/or increasing economic growth
- Making a strong contribution to the GNP
- Meeting discharge and other effluent regulations
- Introducing and expanding new and improved technologies related to quality surface preparation and finishing

Suppliers provide effective stewardship of proprietary products and equipment that allows finishers to produce with consistency and ship quality parts to users. Dedicated basic research and development conducted by suppliers, independent labs and universities continues to identify new finishes that can be used to replace those targeted for environmental reasons.

Some users of surface finishing develop or change specifications to accommodate new processes. Others appreciate the introduction of effective compliant systems and cycle steps that reduce process costs and rejects, while increasing overall productivity. They especially appreciate the marketing advantage when a new process replaces an environmentally hazardous one, because they can tout an "earthfriendly" manufactured product.

Our industry has a full agenda of projects related to developing new products and systems for improving surface finishing processes. The challenges here include:

• Prioritizing needs by listening carefully and understanding set goals

- Categorizing each segment of a project's importance and developing a timetable for completion
- Confirming with an appropriate field evaluation whether a new product or system meets and/or exceeds practical requirements

Change is good. It's part of a continuous improvement process that makes the effort worthwhile. We are part of a worldwide industrial network ushering in a new millennium. Let's take advantage of the opportunities that come with it.

Double the Temperature

To Double Cleaning Effectiveness How many times have we heard that statement? Do you ever wonder how this good old advice relates to effective surface preparation? There is a relationship between the cleaning bath, its temperature and surface tension. Wetting agents or surfactants lower the surface tension of solutions. This improves wettability to allow penetration into soils for easier removal from the substrate. The particular surfactants added singularly or in combination with others are determined by the ultimate application and cleaning demands for the intended cleaner. Typically, small concentrations dramatically reduce surface tension, beyond which larger doses only minimally affect surface tension reduction.

The surface tension in working cleaners is usually 20–35 dyne/cm. By comparison, water is about 70 dyne/cm. Many years ago, substantial theoretical studies were supported by experimental work showing a relationship between temperature of the solution and surface tension. This relationship is almost linear when considering long temperature ranges. It confirmed that surface tension decreases with rising temperature.

Let us consider that the particular cleaner bath's temperature, intended application and immersion times are appropriate. By increasing temperature of the solution, wettability and penetration into soils is improved. The action to lift and either displace or emulsify becomes more efficient and effective. For the purists who need a technical explanation: Increasing temperature causes the free surface energy to pull molecules inward from the solution surface to the interior. This is counteracted by the opposing tendency of thermal agitation to push the molecules outward through the surface and into the vapor phase. Let's keep it simple. Having established a fixed time and the right cleaner chemistry, turn up the heat to clean off those soils before the next process step.

Mail Bag

Recently, a reader contacted us about a quality problem related to finishing costume jewelry. Some of the given information was found to be related in general to several articles written in this column last year, focusing on surface preparation and corrective procedures when handling specific defects. I turned this inquiry over to Matt Stauffer, director of technology, ProSys Finishing Tech, who has a strong background in the costume jewelry industry. His analysis and recommendations follow, integrated with the customer's specific problem descriptions.

"After reviewing the jewelry processing cycle information, there are several possible areas that should be investigated. These include mass finishing of the parts, preplate cleaning and activation and, most importantly, adequate "sealing" of the base metal casting in the plating cycle. Proper mass finishing results in a smooth surface that yeilds a part that is less likely to cause spotting or bleed-out, and provides enhanced corrosion resistance, especially in low-current-density areas that may not get adequate plate coverage in the plating cycle. Improvements in the areas of media matching, compound selection and mass finishing equipment selection should be investigated.

The cleaning cycle should be designed with activation of white metal castings in mind. Over-cleaning can lead to base metal porosity and can result in poor corrosion resistance of the final finish. A mildly alkaline soak cleaner or buffing compound remover-preferably one that is designed for white metal, brass or zinc die cast-should be used. This should be followed by a cathodic electroclean cycle: 10-15 ASF, 20-40 sec. The electrocleaner should contain silicate to protect the base metal.

Cathodic electrocleaning will allow for the use of a more aggressive cleaner without etching the surface. Regarding activation, typical alloys used in jewelry manufacturing can vary tremendously in the percentage of lead and tin, as well as contain a

percent, with the balance being

in a readily activated base metal.

Sulfuric acid-based activators

mostly lead. High tin content results

containing fluoride are usually well

suited to this application. High lead-

activate and require more fluoride.

source of the problem. The most

nk size, gal	Gal/hr skimmed
<i>,</i> 0	
18	1
100	3-6
540	6-12
	100 540

Table 2			
Disk diameter,			
Disk diameter, in.	in. below surface	Gal/hr skimmed	
12	4.5	1-2	
18	7.5	3-5	
24	10	8-10	

wide range of other contaminants. Tin the cycle you provided is that it lacks content will typically vary from 36-92 a nickel plate, likely resulting from the need for a nickel-free finish. This is a common challenge to many jewelry platers, because nothing is as inexpensive and effective at sealing a casting as a bright nickel electroplate deposit. It provides a durable, wellcontaining alloys are more difficult to leveled, corrosion-resistant barrier coat that is an excellent base for gold, The plating cycle is the more likely silver and rhodium decorative top coats. Because "nickel-free" forces critical piece of information regarding platers to look elsewhere, they must

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rely on the combination of acid copper from 10 microns to 15-20 microns. It is also important that the acid copper be fully bright and leveled by maintaining the proper addition rates, as well as the recommended operating temperature of the process. Otherwise, the resulting deposit will be more porous, particularly in low-current-density areas, and, of course, brightness will suffer. If increasing the copper thickness still does not meet the corrosion specification, there may also be a need to increase the palladium thickness, preferably not as much as noted." (Editor's Note: Matt is an active member of AESF's Providence-Attleboro Branch and can be reached at 401/781-1011.)

Is Displacement Cleaning For You? By monitoring the cleaning tank and down-line tanks, here are some practical observations to consider:

• Insufficient emulsificaiton capability of the cleaner, with

relatively short service life of the working bath

- Oils and grease dragging down the line
- Poor cleaning
- · Oily and discolored plating barrels
- Excessive downtime and consumption of waste treatment chemicals, all related to frequent cleaner dumps

Displacement cleaning has a positive impact on all of the above items, as long as the candidate displacement type cleaner is appropriate for the intended application. The emergence of oils and grease on the surface does, however, introduce a new problem: how to efficiently remove them. Belts and disks are relatively inexpensive, durable oilremoval devices. Here are some considerations that should be taken into account.

Belt Width & Length

Although the belt's length is not a critical factor, the width is very

important. Because a surface layer of oil is being skimmed, the belt width is of practical importance to optimize skimming vs. tank size. The examples shown in Table 1 indicate rate of oil pickup based on belt selection.

Disk Diameter

The disk diameter is also important. Available surfaces are to pick up oil increases with disk diameter. Positioning the disk is also critical. Ideally, it should be within the oil layer or just below it. Table 2 shows approximate oil removal and disk selection.

A shallow better conforms to a smaller-diameter disk skimmer. The disks in the table range in weight from 13-19 lb, with a speed of 7-8 rpm. I prefer stainless steel disks because they provide the best service life and durability, and are not prone to warping.

Other viable mechanical oil removal devices include coalescers and ultrafiltration. PASF