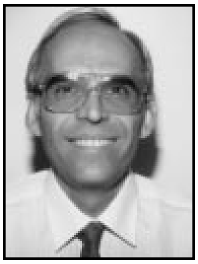

Finishers' Think Tank

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Soak Cleaning ... The Right Stuff

***Columnist's Note:** With a great deal of pleasure and anticipation, I am undertaking this column. Many thanks to Marty Borruso for elevating "Finishers' Think Tank" to its current professional level. Many of us have found his articles to be innovative and informative, as well as excellent resource material. I have known Marty for several years, and we have combined expertise in the lab and in the field (and at numerous local/ national AESF functions). If you have an opportunity to connect with Marty, it will be quality time spent. All of us at* P&SF *wish Marty all the best in his new endeavors to improve the quality of plating and surface finishing under our Society's banner.*

I would like to emphasize in this column my focus on related metal finishing processes, such as surface preparation (cleaning, activation, mass finishing and special treatments), plating applications, environmental concerns/aspects, phosphates, black oxide, stripping—and especially the readers' interests. Readers are encouraged to contact me—either directly or through *P&SF*—with specific questions and/or problems. Each month this column will highlight a selected metal finishing process, detailing recommended procedures and offering resolutions to problems.

An ancient Chinese proverb states that a thousand-mile journey begins with a single step … so here we go!

Soak Cleaning

For several decades, this initial step in most finishing operations had been relegated to a general of "all-purpose" status. The accepted procedure was to use a powdered blend, containing one or more surfactants, alkaline builders, conditioners, maybe caustic (depending on base metal processed). Cleaning was predominantly by emulsifying (*i.e.*, "holding" or encapsulating the soils in a surfactant "cell"). When the reserve cleaner blend became saturated with emulsified oils, its ability to provide adequate surface cleanliness rapidly decreased. Maintenance or booster additions of the cleaner concentrate would restore some degree of cleaning efficiency. This would be a finite control process, however, whereby the cleaner bath would rapidly age, necessitating eventual dumping. It was not a sophisticated control procedure, because years ago, discharge regulations were virtually nonexistent, making frequent cleaner bath replacements a tolerable operating expense.

Let's consider what has happened since the early 1970s that affects the way today's cleaners work ... or *should* work:

- The Clean Water Act
- F-006 sludge reduction
- OSHA safety regulations
- Analysis control
- Easing waste treatment
- Reduction of solvent cleaning as a result of environmental factors and health concerns
- The use of more chemically different oils in stamping, forming, extruding and rust-proofing
- More applications for plating systems that are sensitive to parts cleanliness, such as chloride zinc
- Reduced operating costs

The driving forces described here clarified the need for and development of newer, more effective soak cleaning systems. Formulations are blended to meet any of today's specific requirements. Some of these benefits include:

- Use of biodegradable, complex surfactant mixtures, encompassing specific ratios of different types, such as anionic and nonionic
- Higher levels of oil emulsification
- Rapid oil displacement at operating temperature, with or without solution agitation, or preferred oil displacement on cooling
- Oil splitting agents added directly to the working cleaner bath
- Cleaner formulations compatible with mechanical oil removal equipment
- Stable, concentrated liquid cleaners
- Availability of concentrated additive blends containing only surfactants and other cleaning agents
- Elimination of phosphates, silicates and hard chelates
- Improved rinsing characteristics

Surfactant technology now provides a variety of effective detergents and wetting agents that blend with selected alkaline materials to provide the emulsification or displacement action, as described. Certain surfactants, when added to the working cleaner, will directly split the oils. Unique surfactant combinations can readily remove many different types of process oils, such as chlorinated, mineral, paraffins, hydrocarbon rustproofs, sulfurized and synthetics. Having these surfactant mixtures in the formulation concentrate is referred to as having complex surfactant systems. In barrel cleaning, these agents also prevent oils from adhering to polypropylene barrels exiting the cleaner bath. Specialized surfactant blends also soften and lift buffing and polishing compounds.

Recycling and purification of cleaners have become wise investments to extend bath service life. Acknowledged cost savings are infrequent cleaner dumps, less downtime, reduced demands in waste treatment, less sludge and, most importantly, satisfactory cleaning on a per-shift basis. Sophistication of mechanical filtering aids range from simple belt and disk skimmers to coalescers to micro- and ultrafiltration. Based on the specific user's operating cost data and cleaning application, the capital expense and maintenance of these devices can be readily justified. During recent years, oil displacement has become a more popular method of alkaline cleaning, thereby increasing the useful application of mecahnical filtering devices. Many of the oils can be recycled by certified firms (costing as low as just a freight charge to haul off the oils) used as an additive with fuel oil in plant boilers.

Liquid products have really contributed to improving the overall technology of aqueous cleaning. Concentrated blends, as the name implies, are not bulk water-based, but rather water present in just sufficient quantity for blending. Additives, such as alkalies, conditioners and surfactants, are the heart of these concentrates—just as they are in powdered blends. Many liquid concentrates are equal in dry weight of certain additives to their powdered counterparts. This even includes caustics. Liquid cleaners are just as effective as powders. Field benefits that are attributed to liquid cleaners include:

- Safer, easier to handle; can be pumped through pipes to the process tank from another plant location.
- No dust, caking, splash-back or localized boiling when making additions.
- Analysis can be accurately and quickly determined by measuring the cleaner's conductivity, a direct function of the concentration. Conductivity or torroidal probes activate a pump, which dispenses a sufficient quantity of the concentrate. Desired cleaner concentration is maintained at the set point.
- A 75–85 percent reduction in sludge.
- Tank dumps and new makeups are quicker.
- In many waste treatment applications, metals flocculate and settle faster as a result of reduced dissolved salts in the cleaner solution.
- OSHA-compliant because of reduced worker direct contact.

Unlike standard cleaner blends available in the past, today's powder and liquid concentrates offer different additive packages to meet specific requirements. These include surfactants only, or surfactancy/additive systems. The finisher can maintain a cleaning system with additional detergency, as needed, without exceeding alkalies or other constituents. To optimize the cost of cleaning, proprietary concentrates can be added in ratio with the finisher's source of caustic.

Some cleaners are formulated to be used in both soak and electrocleaning. This simplifies application, inventory and analysis control. Other concentrates improve rinsing characteristics, silicates, chelates, complexors or other targeted components.

Many of the changes in soak cleaning technology, therefore, are the result of meeting a new range of requirements: Operations, environmental and health-related. These items continue to foster change and improvement in the science of soak cleaning. In the shadow of the 21st century, the first step in many metal finishing processes definitely has "the right stuff."

Next month we review electrocleaning ... the right choice. P&SF