Finisher's Think Tank

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Alternative Procedures & Processes

Although many facets of our daily lives may seem to be routine, when it comes to metal finishing there is always something new or different to consider. We may not purposely steer in an alternate direction, but there are many beacons that guide our way. Among these are environmental concerns and regulations, finishing specifications, wear resistance requirements, economics, improved technology, and analytical control. These are some of the driving forces that provide us with alternative processes and procedures. Some of these alternatives that could factor into big improvements for any finishing operation are highlighted below:

Surface Preparation

This is typically the first step in most any plating and surface finishing cycle. I have always felt this first step to be the most important one. Available metal cleaners (soak, spray, ultrasonic, mechanical), by and large are fortified with the latest surfactants, wetters, conditioners, and related cleaning agents. These components, some in specific ratios, markedly improve cleaning efficiency. Additionally, they retain some degree of environmental benefit, such as rapid biodegradability, ease of waste treatment, and safer handling. Some of these new classes of cleaning agents are related to natural products (wood derived, such as terpenes or citrus based), SARA Title III exempt substituted glycol ethers, soy based oils, and new groups of synthesized organic surfactants. Of special interest has been the application of biologically active "bugs," or unique bacteria that breakdown and digest oils and grease. Many cleaning cycles now employ displacement action to remove soils. This significantly increases the cleaner bath service life, thereby easing the burden in waste treatment. The accumulated oils and grease may be removed by mechanical devices, such as coalescers, ultrafiltration (using membrane technology), or automatic skimmers. In many instances these soils are found to be recyclable and can be used to make a variety of products.

Plating Systems

Probably of most significance have been the alloy zinc processes. As the predominant metal in the deposit, zinc ranges from 80 to more than 97 percent. It has been developed into very successful plating baths with nickel, iron, cobalt, and tin (at over 2:1 tin to zinc). By adhering to specific operating parameters and plating thicknesses, chromated deposits can exceed 500–1,000 hours of salt spray to red rust (ASTM B-117). The automotive industry was quick to embrace the various corrosion and service life benefits of alloy zinc deposits. Other popular applications include aircraft and aerospace, military, ocean and freshwater transport, fasteners, and bearings. Acidic and alkaline processes are commercially available. The tin bath is close to neutral pH.

Chromium plating has undergone an overhaul that includes a suitable trivalent alternative for decorative applications. Trivalent chromium is significantly more user friendly. It does not retain the negative features of hexavalent chromium (corrosiveness, toxicity, assorted health issues, such as carcinogen classification). Trivalent chromium plating baths are approximately twice as efficient compared to hexavalent chromium baths. This results in greater production throughput. The deposit is self limiting, making it solely a decorative process.

Nickel/cobalt alloy baths are another interesting process. This alloy system deposits a decorative blue-white deposit, that can, in certain applications, replace chromium.

Alkaline copper plating has replaced traditional cyanide based copper plating in some applications. The main benefit has been that it is an alternative to the cyanide based system. In this regard cyanide can be eliminated, which doubles as a health and safety issue bonus. Alkaline copper deposits can be bright or semi-bright. It is suitable for just about all processes for plating over steel. The only drawback has been the inability to sufficiently barrel-plate zinc parts.

Nickel/iron plating baths were developed many years ago in response to the high price of nickel. Although this process is still available, it has not seen the popularity that it enjoyed when first marketed.

Chromates

Replacing hexavalent chromates has been acknowledged for some time. Health issues, toxicity and corrosiveness of hexavalent chromium have always been propelling the need to change. The obvious alternative was chromating from trivalent systems. Trivalent baths of the clear (blue) color have been in commercial use for about 20 years. In recent years, yellow and black trivalent chromates have been introduced. This development occurred rather quickly as a result of ELV (End of Vehicle Life Directive), RoHS (Restrictions on The Use of Certain Hazardous Substances), and WEEE (Waste Electrical and Electronic Equipment Directive).

Prepaint

If your September '04 issue of *P&SF* is still around, refer to my column about a new technology. It introduces an organic immersion coating that can replace iron phosphate in prepaint cycles.

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Finishing Facts

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DeVilbiss, Binks and Owens Community College have teamed up to present a Spray Finishing Technology Workshop May 18–20, 2005 in Toledo, OH. Classes will meet from 8:30 a.m. to 4 p.m. daily and include classroom and hands-on sessions. Two continuing education units (CEUs) are awarded for the course.

Attendees should be involved with industrial, contractor or maintenance spray finishing applications, or spray equipment sales and distribution. Topics for the workshop include:

- Equipment types and selection.
- Equipment set-up, operation and maintenance.
- Surface preparation and defect analysis.
- Material selection.
- Safety and regulatory concerns.

To register, or for additional information, contact Jaime Hollabaugh, Owens Community College, Workforce and Community Services Division (800/466-9367, ext. 7354; spraywrokshop@netscape.net). More information is available on-line at www.owens.edu/workforce_cs/index.html.

Special Materials Company, Cherry Hill, NJ, has announced the completion and start-up of a 50-percent capacity expansion project for sodium hypophosphite (SHP) at its Changshu New-tech Chemicals Company facility in China. The plant now has the capacity to produce 5,000 metric tons per year.

Changshu New-tech Chemicals is a joint venture founded in 2002 between Special Materials Company and Changshu Xinhua Chemicals Company of China. The facility produces SHP, Hypophosphorous acid and its salts, THPS, and other phosphonium compounds.

In Memoriam

Marilyn Sanicky died on August 19, 2004, following complications of kidney problems. She was an active contributor to the metal finishing industry for more than 40 years, and an active member of the AESF Cleveland Branch.

Sanicky authored many articles and papers for professional and trade journals on laboratory methods to facilitate control of plating baths. Her speciality was the Hull cell. She was the author of the *AESF Illustrated Lecture Series* on "The Use of the Hull Cell." She was also a frequent speaker at AESF Branch meetings and made a number of presentations at national technical conferences.

A graduate of Fenn College in Cleveland, Sanicky started in the metal finishing industry as a laboratory technician for Incar, a supplier of proprietary plating products and processes in Cleveland. She also served as technical director for Electrochemicals, Inc., another Cleveland-based supplier of plating and post-plating technologies.

After leaving Electrochemicals, Sanicky joined H.O. Hull Company, which later became Rohco, and then McGean Rohco in the early 1980s. When she retired in 1993, she was technical service director. Following retirement, she consulted for McGean Rohco for several years.

Sanicky's outside interests included golf, and she was active for many years as a track official for the Amateur Athletic Union (AAU). She authored the original *AAU Track and Field Guide for Women*.

Answers to I.Q. Quiz #403

1. Kilograms of force per square millimeter (kgf/mm^2). Same for Knoop hardness.
2. Adhesion.
3. Tensile strength and ductility.
4. Spiral contractometer; plating stress.
5. Perfect adhesion exists when the strength of the bond between the coating and the substrate exceeds the strength of either one.

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Bright Dips

For many years, brass and copper alloys were bright dipped in fuming acids. These solutions contain a balance of inorganic and organic acids. Although fast acting, their highly corrosive nature and liberation of nitric oxide (brown gas), make these baths very tough to handle and work. Two safer, easier to handle and control alternative bright dips are available. One consists of stabilized hydrogen peroxide, inhibitors, and sulfuric acid. The other is made up of iron salts, sulfuric acid, stabilizers, and inhibitors. Both are development equivalent bright finishes to the fuming acids, but they are non-fuming.

Related Items

Some other alternatives to consider relate to equipment. More efficient, easier to maintain and service, and overall reliability attest to the improved status of metal finishing equipment. A bonus has been the use of better materials of construction that resist the corrosive shop environment. Where appropriate (ex. rectifiers), calibration delivers consistently desirable results and performance on an on going basis.

Analysis offers an opportunity to improve in-house process control and troubleshooting. Drop method test kits can be replaced by more accurate titration burettes. Hull cells provide a good representation of any plating bath's performance. Accurate thickness testers confirm whether a specification has been achieved. Customers really appreciate knowing their platers maintain a functioning, updated lab. They are relieved to know the plater keeps complete control and service of baths used to process their parts. It means that jobs get done right and on time in baths that are in optimum working order.

Alternative procedures and processes are readily available. Improvements are on-going. Our success is linked to being innovative and continually progressing. The concept of tanks filled with aqueous solutions has been with us since our industry evolved. But it is what we put in the tanks, and how innovative we are, that bodes us well into the future. ***P&SF***