Finishers' Think Tank

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2001: A Plating & Surface Finishing Odyssey

Seems like only a few days have passed since we held our collective breaths, while the world struggled with the Y2K phenomenon. It came and passed with relative quiet. Hardly a rectifier or process bath was disturbed. The new year provided a quiet, unassuming start. Time literally flew while you had fun in the metal finishing industry. Can you remember what projects or jobs were last January's priority? How about production demands in May? Or maintenance requirements in July? Certainly September is still clear. Perhaps one minute detail is a bit uncertain. Thank goodness for record keeping and computer back ups, using only the Y2K compliant smiley labeled ones, of course. We're only as good as our accurate records will attest.

If you count from one to zero as I do, then 2001 is the first year of the new millennium. For those who do, last year was a warm up in the bullpen, before the big ONE. For those who don't, thanks for saving our seat. The exciting part of this "new millennium" phrase, is the anticipation of adventure, exploration, and an odyssey not to be missed. It reminds me of Stanley Kubrick's classic film version of Arthur C. Clarke's short story, about two astronauts on their way to Jupiter. It focused on intelligence as a division between human and animal. HAL, the computer, interacted with Dave. The human crew of Dave and Frank were on a mission to discover what alien force was watching us. The ending has always been open to various reviews, enhancing the film's popularity.

Our trip on the "plating and surface finishing express" is a one-way odyssey across challenging seas of change, over rugged terrain of compliance, through extreme hot and cold, along specification routes, into the land of progress. If our desire and quest is committed to "do things better," then our ticket on the surface finishing express never expires. With initiative as our unlimited fuel supply, we can't miss in 2001. The great part of our mission is the never-ending quest for improvement and change. The change is ongoing and positive. We have critical links to the past that are standard operating conditions, upon which only refinements can be made:

- Surface preparation
- DC plating
- Post finishing
- Rinsing
- Fixturing parts
- Process cycles

These essential parts of any cycle seem as easy to change as the common wheel. The basic design of the wheel makes it such. However, it has evolved from stone, to wood, to natural rubber, to synthetic rubber, and modified polymers and plastics. The basic cycle has also evolved in many different ways, providing unique coatings, new finishes, flexible applications, and improved service life and corrosion resistance. Stroll through most any operating line, and the "nuts & bolts" of it share a strong bond with the industry's beginnings. Look closer and you may see throwbacks similar to what I still regularly do: three wooden tanks in use (two rinses and a nickel bath), plating generators, and molasses/instant Postum™ brighteners.

Recent industry developments are worth noting as contributing to positive advancements. The way time races on, we can encompass the last twenty years, in a flash of activity.

Cleaning

- Displacement cleaning. Soils are removed and either float or sink, facilitating their removal. The working cleaner bath service life is extended, contaminants are minimized, effective cleaning mechanism over life is close to the initial make up.
- Emulsifying cleaners that can hold 2 to five times more oils and grease than previous formulations.
- Biologically active soak cleaning. Unique "bugs" help the traditional surfactants and detergents clean parts, then "enjoy" the contaminants as a meal. Extended cleaner life and significantly less sludging.
- Liquid cleaners. All the benefits of powdered blends, without the associated handling difficulties. Less sludging, easier to waste treat. Available in multi-component systems.
- Liquid and powder blends that replace chlorinated solvents. Health advantages and helping to meet provisions of the Montreal Accord are significant benefits.
- Use of more effective and biodegradable surfactants and wetting agents.
- Replacing cyanides, EDTA, NTA, and other hard chelates with just as effective complexing agents.
- Popularity of Sara Title III exempt solvents.
- Better implementation of ultrasonics and mechanical agitation.
- Mechanical equipment for removing oils and grease. Degrees of sophistication range from belts, to coalescers, to membrane technology.
- Cleanliness tests. Elegant methods such as contact angle measurement, UV activity, total organic analysis and surface extractions complement the effective water break test standby.

Pickling & Descaling

- Powdered acid salt mixtures effectively replace liquid mineral acids. The equivalent or better performance activity is coupled with eliminating the handling and storage of the liquid acids.
- Longer service life, convenient, safe replenishment.
- Controlled, buffered action minimizes smut generation, penetrates into rust and scale.
- Inhibitors control surface action and minimize immersion deposits.
- Detergency provides secondary removal of oils and grease.

Nickel Plating

- Modern synthesis techniques produce higher purity brightener and leveling additives. These materials promote improved deposit characteristics, while minimizing the stress contribution. Chrome receptivity is improved.
- Higher purity additives also improve corrosion resistance of layered deposits, such as in the step test.
- Additives are stabilized to prevent oxidation and related instability and breakdown.
- Higher purity salts and equivalent liquid concentrates, help maintain desired deposit characteristics.
- Rapid leveling permits, where tolerable, thinner deposits. Nickel cost savings are realized.
- Four or more additives required on an ampere hour basis have been simplified into one or two maintenance products.
- Special organic agents promote whiter deposits when metallic contaminants such as copper, iron, and zinc would otherwise form dark, pitted, rough deposits.
- Specialized clays, diatomaceous earths, and carbons increase the quality of filtration.

Decorative Trivalent Chrome Plating

- In an instant, the efficiency of chrome plating doubled from 10-15% to 25-30%.
- Replacement of hexavalent chromium eliminated all of its related health and handling hazards. OSHA calculated over 99% reduction in handling risk factor.
- Coverage improved to the "plates wherever there is a nickel undercoat."
- Eliminated blowholes and high current density burning.
- Metallic contaminants such as copper, nickel, iron, and zinc can be removed by dummy electrolyzing.
- Tolerates current interruption. Whitewash no longer a problem.
- Higher racking density increased productivity.
- Less concentrated trivalent chromium solution versus higher level of hexavalent chromium. Simpler, one step alkaline precipitation for the trivalent chromium.
- Less viscous solution, for less drag out. Better drainage and rinsing characteristics.
- Better process understanding led to improvements in operation, control, maintenance, and troubleshooting.

Decorative Hexavalent Chrome Plating

- Stable fume suppressants reduce corrosive fumes by over 98%. These are available as thin foam blankets and solution surface tension lowering.
- Two and three catalyst systems increase efficiency by up to 2(+) times.
- Evaporators more efficiently concentrate the solution, returning less water and more electrolyte. The economics result in reduced additions of plating salts/additives and less demands on waste treatment.
- Engineering improvements offer very low AC ripple rectifiers.
- Ion exchange and porous pots more efficiently remove metallic contaminants and reoxidize excess trivalent chromium.

Perhaps the biggest initiative for improvement has occurred in the plating solutions. Replacing cadmium, eliminating cyanides, improving corrosion and wear resistance, reducing waste treatment demands, and meeting environmental/compliance, have all been drivers pushing these efforts. Next month we review some of these systems: plated deposits (with top coats), alloys, newer acid, neutral, and alkaline baths. AESF is in the thick of it, sponsoring R&D efforts at universities in order to identify and develop new processes. Check the Research Sponsors program the next time you log on to aesf.org.

2001 and beyond. What a challenge! *P&SF*

Think Tank Trivia

- Traditionally "indexing" nickel brighteners are especially active in low current density deposits. They enhance brightness and leveling. Also operate in tandem with the maintenance brightener, to keep desired, uniform deposit throughout all the current densities.
- Single and double arm automatic return type plating machines are particularly susceptible to bipolar conditions. One or more carrier arms become insulated or break contact, inducing bipolarity. Examples of this problem are nickel etch and chrome white wash. Minimize problem by maintaining clean contacts and applying conductive grease to the rails.