Do's & Don'ts



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Hot Alkaline Cleaners

Hot alkaline cleaners are still the most used to prepare metal items for plating. They are sometimes called degreasers since they are often used to remove grease, heavy and light oils, wax-based burring compounds, grinding and polishing compounds, as well as "dirt" of many types including particulate matter. Poor cleaning equals poor adhesion, nodules, pits, poor corrosion resistance and poor coverage of plated deposits.

I have seen abuse of these cleaners many times. I hope to call your attention to practices that can improve cleaning, lower costs, improve efficiency, rinse better and last longer.

Hot alkaline cleaners usually contain chemicals that saponify oils and greases, water softeners, detergent (surfactant)-dispersing agents and oxide removers. These cleaners can be used in spray or immersion modes. If spray is used, special non-foaming or low-foaming surfactants must be used in the formula. Otherwise the foam would build up and be detrimental to the process.

Do Maintain the optimum cleaner concentration. The concentration range shown on the proprietary cleaner's operating data sheet should not be violated. Two times the cleaner concentration is not two times the cleaning. *Au contraire*, splitting-out of some or all the surfactants would likely occur, resulting in little or no cleaning and a film of surfactant acting like oil on the work piece.

Do Maintain the recommended temperature. High temperatures can also split-out surfactants. Generally the higher the temperature the better the cleaning within the temperature range recommended for the product you are using. Some cleaners are formulated to clean well at low temperatures to conserve energy and reduce costs. Note that many buffing compounds contain wax. To properly remove wax, it should be melted to be removed thus requiring a higher temperature cleaning formulation.

Do Select and use the correct alkaline cleaner that is designed to clean the soils that must be removed. Confer with your supplier. Sometimes the lowest cost and most effective results are obtained using two types of cleaners instead of one for all. For example cleaner number one could be a "heavy duty cleaner" designed to remove oils and greases. After rinsing, a second cleaner to finish the job is good. Each cleaner product is designed and optimized in composition, concentration and temperature to deal with different soils.

Do Use skimmers on the cleaner tanks when heavy oils or large amounts of light oils are to be removed. Oils tend to split out after a large amount is introduced into the cleaner. The ability to remove the oil from the surface becomes important to prevent oils from clinging to the workpiece as it is withdrawn from the tank. Also the life of the cleaner can be extended before it must be discarded. Under these circumstances it is best to use a second cleaner after rinsing.

Do Discard (send to waste treatment) when the soil load is high enough to cause residual soils on the surface of the work-pieces, preferably before there is detectable soil left on the parts. A simple test can be used as a guide to determine the life of the cleaner.

Usually there is a test procedure based on alkalinity of the cleaner solution that is provided by the suppliers of proprietary cleaning compounds. However an additional test for the surfactant content may be useful. In a stoppered 100-mL graduated cylinder, add 50 mL of cleaning solution. Add intervals of light oil such as 5 mL each at a time, shaking the stoppered cylinder each time. Continue until there is no foam. If this is done on a newly made up cleaner, a standard is created. Testing of the used cleaner is done the same way, noting how much light oil is required to stop foaming. This will indicate the percent useful life of the cleaner.

Do Use soft or DI water for make up and maintenance of the cleaner solution. Most proprietary cleaner compounds include a water softener. However the water softeners may be used up in the course of maintaining the tank level using hard water, particularly when the operating temperature is high, resulting in large evaporation loss. Hard water products of calcium and magnesium can precipitate in the cleaner tank resulting in undesirable particulate matter that may cling to the work pieces. The result could be rough, or pitted or nodular or dull plated deposits and possibly all of these defects.

Do Use a filter or centrifuge. There are filters designed for use in hot alkaline cleaners. They are effective in removing particles that may otherwise stick to the workpieces.

Do Use agitation to aid cleaning efficiency.

Do Use counter flow rinsing

Don't Rush through rinsing. Strong alkaline cleaners are hard to rinse.

Don't Over-agitate. Solution circulation is a good method of agitation. Eductors can be used if pumping pressure is not too high. Connect eductors to the discharge of the filter for best results. Distribute them evenly in the tank. Over-agitation could result in foaming.

Don't Neglect the cleaner solutions and equipment. The chemistry system needs frequent additions and close temperature control.

Last but not least: Be aware of silicates used in most alkaline cleaners. Silicates can form insoluble compounds that cling to the workpieces that if not rinsed well, can cause many defects in the plated deposit. Most prominent is loss of adhesion, but also pitting, pores, roughness, etc., can arise.

Most strong alkaline cleaners have sufficient sodium hydroxide to allow effective rinsing. The hydroxide keeps the silicates soluble. If the cleaner solution is not maintained by the recommendations, the pH may drop, resulting in the rinsing problem noted above.

Low alkaline cleaners such as those used for cleaning aluminum can create rinsing problems as the result of precipitation of silicate compounds on the surface of the workpiece. It is not recommended to increase the alkalinity of the cleaner because etching can occur. The less etching of aluminum the better the results will be. If etching is necessary do it in the triacid step, not in any alkali step including the cleaner. Having said that, some soils require slight etching in the cleaner to be removed. Keep the etching to a minimum. The first zincate etches aluminum. This is a necessary part of the procedure. The best adhesion and smoothness is achieved with the lightest amount of etching.

I Do Wish you all good plating. P&SF

Answers to I.Q. Quiz #438

- 1. The solutions contain considerably lower chromium concentration (down to 0.7 oz/gal) and are much more sensitive to changes.
- 2. No. Trivalent chromium is tolerant of current interruptions.
- 3. The range of current efficiency is higher, running about 35 to 40%.
- 4. True. They will also increase stress and reduce covering power.
- 5. Chloride and sulfate.

In Memoriam



AESF Researcher and Penn State Professor Bill Bitler passes on

We have received word that **Dr. William R. Bitler** passed away on April 18, 2007. Dr. Bitler earned a Bachelor's Degree, Master's Degree and Ph.D. in Physics from the Carnegie Institute of Technology. Dr. Bitler began his teaching career at Carnegie Institute of Technology in Metallurgy and came to Penn State in 1962, where he was first an Associate Professor (1962-1970) and then a Full Professor until 1995, when he became Professor Emeritus. His interests were broad, ranging from physical metallurgy to magnetic materials. After becoming Emeritus, he continued to teach on an ad hoc basis for several years.

In the College of Earth and Mineral Sciences at Penn State University Dr. Bitler contributed many students to the surface finishing industry over the years, through the AESF Research Program. His project work on interdiffusion of electrodeposited metal coatings contributed much to the understanding of several multilayer coating applications. Among them were a study of the iron-zinc system, applicable to electrogalvanized automotive sheet steel, work on the properties of electrodeposited diffusion barriers in electrical contact systems and the interdiffusion of electrodeposits with basis metals.

Dr. Bitler will also be remembered for his dry wit and his personal rapport with many students. He was an avid handball player. Perhaps most memorable is a quote familiar to many of his students over the years. Whenever perplexed, surprised or otherwise caught off guard, out came the inevitable "Great Scott!" It became a familiar catchphrase to many who knew Dr. Bitler. Indeed, on hearing of Dr. Bitler's passing, three of his colleagues, who happened to be having dinner together in State College, raised their glasses and in a toast to Bill Bitler, said, "Great Scott!"

Memorial contributions can be made in Dr. Bitler's name to the Robert W. Lindsay Memorial Scholarship. Checks can be made out to Penn State University, College of Earth and Mineral Sciences, attn: Robert W. Lindsay Memorial Scholarship. Send to: College of Earth and Mineral Sciences, Development Department 105 Deike Bldg., University Park, PA 16802.

Contributed by the Penn State College of Earth & Mineral Sciences and James H. Lindsay