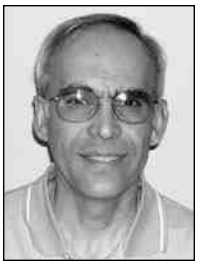

Finishers' Think Tank

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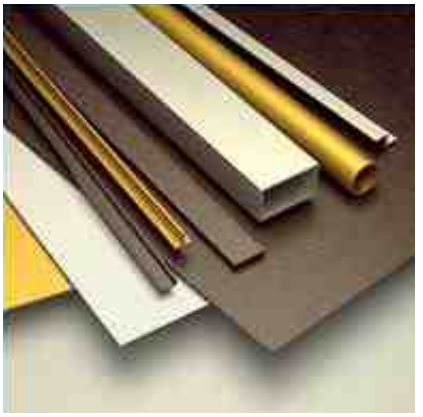
Aluminum Finishing: Know the Facts

It may sound easy, but aluminum provides its own specific challenges as regards effective surface preparation before plating. There are important considerations, such as cycle requirements, designations of alloys and castings, and processing limitations. Being unique unto itself, aluminum surface preparation employs specific steps not familiar to the typical cycles for the more common ferrous and non-ferrous basis metals. It is more interesting, since aluminum is the most electropositive element, or least likely for satisfactorily plating directly on to the substrate. I would like to share some of my experiences using the different types of treatment solutions in typical cycles.

An overall surface preparation for plating may follow the following progression:

1. Ultrasonic, mechanical or solvent clean to remove buffing and polishing compounds.
2. Soak clean in a non-etching, mildly alkaline solution.
3. Rinse
4. Alkaline or Acid etch
5. Rinse
6. Zincate
7. Rinse
8. Optional strip zincate
9. Rinse
10. Optional Re-zincate
11. Rinse
12. Proceed to specific electroplating or electroless step

The first step in cleaning employs mechanical action to assist in dislodging tough soils. Special cleaning formulations are used containing unique solvent and detergency agents. Among alternatives are the stand alone organic solvents. There has been an exodus from the chlorinated types to alternatives, such as the n-propyl bromide types. Traditional soak cleaners in Step 2 above are formulated providing a buffer in the working range of pH 9-10, greatly minimizing or eliminating any etching. It is especially important that non-etch cleaners are used where contact is made on highly polished surfaces. Naturally these cleaners are non-silicates and do not contain any caustics. For the most part these are non-corrosive solutions. Cleaners of this type will remove oils, grease and shop dirt, as encountered on typically soiled parts. The cleaning mechanism would be either by emulsification or displacement.



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Rinsing, as applies in each step, is very important. It is not just that rinsing is achieved between treatment steps, but that contaminants and dragged-on solutions be effectively washed off the surface prior to the next step. Reviewing the cycle will confirm that alternating alkaline and acid treatments follow one another. That is why multiple rinses are favored, such as double and triple counterflow types. Fog mists and water sprays are also effective in this regard. Clean, rinsed surfaces are very important as the critical zincate step must be satisfactory, developing a strong adhesive bond to the aluminum surface for subsequent plating.

Etching can be accomplished in alkaline or acidic solutions. The focus of treatment is to remove the surface oxide skin, as a means to developing an active surface for zincating.

The more common type of alkaline etch is the highly caustic solution where parts are aggressively etched. Surface conditioning is aided by sequestering agents, chelates, defoamers and wetting agents. Removal of the surface aluminum oxide leaves a smutted surface. These are the insoluble oxides of the particular alloying metals. Modifying the operating parameters (time, concentration and temperature) will affect the rate of aluminum etching. Heavier or prolonged etching develops more smut.

A second type of alkaline etch is usually termed the mildly alkaline etch. This treatment employs a steady, mild or micro-surface etch. It is preferred where geometric surface conditions require minimal surface metal removal. Other critical surfaces may include areas such as threaded holes. The main focus is to remove the oxide skin while preserving surface integrity. These mild etchants contain wetters, surfactants and surface conditioners. There are formula modifications for controlled, uniform etching and cleaning.

A third type of etch is the acidic process. These solutions are usually a combination of two or more mineral acids in balance with organic acids, surface conditioners and wetting agents. The oxide skin is removed, but usually less aggressively. This is important for polished surfaces, or where it is preferred to substitute, as less aggressive, for the alkaline etch. It has also been established that for some electroless nickel applications, acid etching of aluminum develops a surface structure more favorable to this type of deposition. There is another branch of the acid etch that is fluoride-based. This type of bath,