Finisher's Think Tank

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Caught on the Fly

The fascinating and rewarding parts of this industry can be seen in our every day activities. No matter how much time spent doing and learning, the rewards provide us with invaluable experience, helping us do our jobs better. Trouble shooting, understanding processes and why specific treatments are required, knowing how to adapt, what to use, when to and when not to, optimum operating parameters, analysis procedures, are just some of the various subjects of concern for successful metal finishing. In many instances we sort of take some things for granted. The following items were prepared as a possible list of interesting and helpful facts.

Aluminum

We associate this metal with it's superior strength, as similar to steel, but at about half the weight. Why is this so if aluminum itself is soft and pliable? Raw aluminum is alloyed with metals, such as magnesium and silicon. The product is then baked, which transforms the alloy into a strong, durable material. What has not been understood until recently is how the alloy structure forms and how it promotes high strength. First, the element silicon forms a pillar and skeleton assembly. On this assembly forms particles of an inorganic complex consisting of magnesium, silicon and aluminum. This critical structure then forms an additional inorganic species made of magnesium/silicon. It is this formation that inhibits the tendency for aluminum to behave as a smooth metal. Now that this heating and annealing process is more understood, even stronger and more workable aluminum alloys may be formed. This can lead to many benefits, such as further reducing the weights of motor vehicles, resulting in better gas mileage.

Duplex Nickel

To obtain the optimum corrosion protection of nickel plated parts with a flash of chrome, such as in automotive applications, duplex nickel has been found to be most effective. Of the typical dual nickel deposit, a 75% underlayment of semi-bright nickel followed by a 25% topcoat of bright nickel provides an excellent corrosion protection. In fact, controlled corrosion testing confirmed that corrosion on copper/bright nickel/chromium plated zinc die cast parts occurred within 12–18 months in severe testing environments. By substituting an equal thickness of duplex nickel, the corrosion was delayed for at least 24 months. What is also interesting is the ductility of the semi-bright deposit, which is at least 500% greater than that of the bright deposit.

Trivalent Chromium Plating

This process uses inert anodes, inorganic trivalent chromium salts, conductivity salts, complexing agents. wetting agents, and grain refiners. The plating solutions are typically blue to blue green in color, depending on the particular proprietary bath commercially used. All the health and safety hazards associated with hexavalent chromium baths is eliminated. The reduction of trivalent chromium to the metallic state requires three electrons versus the same reaction that requires six electrons for the hexavalent chromium ion. Therefore, the trivalent chromium bath is at least twice as efficient as the hexavalent bath (approximately 30% compared to approximately 10%). For decorative plating applications, trivalent baths support larger surface areas per flight bar (more parts), giving greater production throughput. Trivalent chromium deposits are typically slightly darker than hexavalent deposits. However, trivalent chrome baths deposit the metal to a limiting thickness, of perhaps 20 millionths inch. There is a point in the deposition process where the thickness becomes self limiting. This is unlike the hexavalent bath, that will keep building in thickness. Unlike hexavalent baths, trivalent solutions will not passivate unplated steel surfaces (such as the inside of tubes). Therefore, chrome free passivating post dips may be required. There was a big push to introduce decorative trivalent chrome baths in the 1980's and early 1990's.

Because the new PEL (permissible exposure limit) for hexavalent chromium and all other hexavalent chromium compounds is 5 micrograms per cubic meter of air as an 8-hour time-weighted average, decorative trivalent chromium baths should regain practical consideration. In addition is the fact that trivalent chromium deposits meet the ELV directive and comply with RoHS.

Nasty Oils

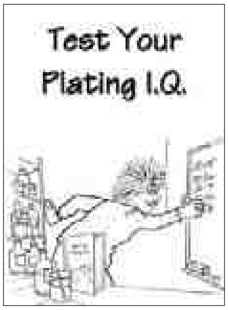
Certain oils can be really tough to remove in the soak cleaner, especially if they adversely affect the finishing cycle. Chlorinated and paraffin oils can literally gum up on parts. I have found this to occur especially when using caustic (sodium or potassium hydroxide) based cleaners. Better cleaning results can be obtained in non caustic, alkaline cleaners that are silicate based, containing specific ratios of nonionic to anionic surfactants. Molybdenum sulfide lubricating grease can also be a tough material to clean off. The above, general described soak cleaner type may also work best. Mineral, spindle, and water soluble oils, may best be removed in a soak cleaner that contains approx. one quarter caustic and silicates, in addition to the above mentioned surfactants, with additional dispersing agents. Evaluation in any specific cleaner of interest is strongly recommended, adhering to the range of given operating parameters. Post cleaning observations and appropriate testing should lend sufficient confidence to the soak cleaner choice.

Rust Spots in Electrocleaning

How many times have you noticed steel parts exiting the electrocleaner with a brown, stained appearance? Or worse yet, brown splotches and even high current density burning? It happens in rack and barrel. Chances are that either it's the wrong electrocleaner formulation, or the right one that is under concentrated. A lack of reserve alkalinity in the bath will not be able to dissolve the iron hydroxide film that forms on the surface, during anodic conditioning. This reserve alkalinity is referred to as caustic soda. Even less caustic results in poor conductivity that tends to etch and burn the high current density. Adjust the operating electrocleaner concentration, or switch to an appropriate concentrate blend.

Corrosion Spots after Electrocleaning

This is another problem that occurs in rack and barrel systems. Parts exiting the bath can be examined and found to have black dot spots on them. Acid dip and the surface now exhibits corrosion spots. This problem is typically found in double cleaning cycles, or where racks or barrels cross over between the acid and electrocleaner. Drag in of the first hydrochloric acid solution in the second electrocleaner, introduces chloride, as a contaminant. During anodic treatment, chloride is attracted to the part, forming chlorine gas bubbles (oxidation product). The bubbles remain in place long enough to etch the steel. Corrective measures include switching the acid from hydrochloric to a suitable alternative, such as sulfuric acid. Otherwise better rinsing between the acid and electrocleaner is required. Or by focusing on the electrocleaner, switch to a sufficiently inhibited formulation, that will prevent this corrosive etching on steel. *P&SF*



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