

painting and other coating processes, and special electrical and mechanical properties. Wastewater generated during anodizing includes spent anodizing solutions, sealants, and rinse waters. Because of the anodic nature of the process, anodizing solutions become contaminated with the base metal being processed. These solutions eventually reach an intolerable concentration of dissolved metal and require treatment or disposal. Rinse water following anodizing, coloring, and sealing steps typically is discharged to a treatment systems.

Carbon Black Deposition involves coating the inside of printed circuit board holes by dipping the circuit board into a tank that contains carbon black and potassium hydroxide. After excess solution dips from the circuit boards, they are heated to allow the carbon black to adhere to the board.

Catalyst Acid Pre-Dip uses rinse water to remove residual solution from a part after the part is processed in an acid bath. The wastewater generated in this unit operation is the rinse water.

Chemical Conversion Coating without Chromium is the process of applying a protective coating on the surface of a metal without using chromium. Such coatings are applied through phosphate conversion (except for "Iron Phosphate Conversion Coating," see appendix B of this part), metal coloring, or passivation. Coatings are applied to a base metal or previously deposited metal to increase corrosion protection and lubricity, prepare the surface for additional coatings, or formulate a special surface appearance. This unit process includes sealant operations that use additives other than chromium.

(1) In phosphate conversion, coatings are applied for one or more of the following reasons: to provide a base for paints and other organic coatings; to condition surfaces for cold forming operations by providing a base for drawing compounds and lubricants; to impart corrosion resistance to the metal surface; or to provide a suitable base for corrosion-resistant oils or waxes. Phosphate conversion coatings are formed by immersing a metal part in a dilute solution of phosphoric acid, phosphate salts, and other reagents.

(2) Metal coloring by chemical conversion coating produces a large group of decorative finishes. Metal coloring includes the formation of oxide conversion coatings. In this operation, the metal surface is converted into an oxide or similar metallic compound, giving the part the desired color. The most common colored finishes are used on copper, steel, zinc, and cadmium.

(3) Passivation forms a protective coating on metals, particularly stainless steel, by immersing the part in an acid solution. Stainless steel is passivated to dissolve embedded iron particles and to form a thin oxide film on the surface of the metal. Wastewater generated during chemical conversion coating includes spent solutions and rinses (*i.e.*, both the chemical conversion coating solutions and post-treatment sealant solutions). These solutions commonly are discharged to a treatment system when contaminated with the base metal or other impurities. Rinsing normally follows each

process step, except when a sealant dries on the part surface.

Chemical Milling (or Chemical Machining) involves removing metal from a part by controlled chemical attack, or etching, to produce desired shapes and dimensions. In chemical machining, a masking agent typically is applied to cover a portion of the part's surface; the exposed (unmasked) surface is then treated with the chemical machining solution. Wastewater generated during chemical machining includes spent solutions and rinses. Process solutions typically are discharged after becoming contaminated with the base metal. Rinsing normally follows chemical machining.

Chromate Conversion Coating (or Chromating) involves forming a conversion coating (protective coating) on a metal by immersing or spraying the metal with a hexavalent chromium compound solution to produce a hexavalent or trivalent chromium compound coating. This also is known as chromate treatment, and is most often applied to aluminum, zinc, cadmium or magnesium surfaces. Sealant operations using chromium also are included in this unit operation. Chromate solutions include two types: (1) those that deposit substantial chromate films on the substrate metal and are complete treatments themselves, and (2) those that seal or supplement oxide, phosphate, or other types of protective coatings. Wastewater generated during chromate conversion coating includes spent process solutions (*i.e.*, both the chromate conversion coating solutions and post-treatment sealant solutions) and rinses. These solutions typically are discharged to a treatment system when contaminated with the base metal or other impurities. Also, chromium-based solutions, which are typically formulated with hexavalent chromium, lose operating strength when the hexavalent chromium reduces to trivalent chromium during use. Rinsing normally follows each process step, except for sealants that dry on the surface of the part.

Chromium Drag-out Destruction is a unit operation performed following chromium-bearing operations to reduce hexavalent chromium that is "dragged out" of the process bath. Parts are dipped in a solution of a chromium-reducing chemical (*e.g.*, sodium metabisulfite) to prevent the hexavalent chromium from contaminating subsequent process baths. This operation typically is performed in a stagnant drag-out rinse tank that contains concentrated chromium-bearing wastewater.

Cyanide Drag-out Destruction involves dipping part in a cyanide oxidation solution (*e.g.*, sodium hypochlorite) to prevent cyanide that is "dragged out" of a process bath from contaminating subsequent process baths. This operation typically is performed in a stagnant drag-out rinse tank.

Cyaniding Rinse is generated during cyaniding hardening of a part. The part is heated in a molten salt solution containing cyanide. Wastewater is generated when excess cyanide salt solution is removed from the part in rinse water.

Electrochemical Machining is a process in which the part becomes the anode and a shaped cathode is the cutting tool. By

pumping electrolyte between the electrodes and applying a current, metal is rapidly but selectively dissolved from the part. Wastewater generated during electrochemical machining includes spent electrolytes and rinses.

Electroless Catalyst Solution involves adding a catalyst just prior to an electroless plating operation to accelerate the plating operation.

Electroless Plating involves applying a metallic coating to a part using a chemical reduction process in the presence of a catalysis. An electric current is not used in this operations. The metal to be plated onto a part typically is held in solution at high concentrations using a chelating agent. This plates all areas of the part to a uniform thickness regardless of the configuration of the part. Also, an electroless-plated surface is dense and virtually nonporous. Copper and nickel electroless plating operations are the most common. Sealant operations (*i.e.*, other than hot water dips) following electroless plating are considered separate unit operations if they include any additives. Wastewater generated during electroless plating includes spent process solutions and rinses. The wastewater contains chelated metals, which require separate preliminary treatment to break the metal chelates prior to conventional chemical precipitation. Rinsing follows most electroless plating processes to remove residual plating solution and prevent contamination of subsequent process baths.

Electrolytic Cleaning involves removing soil, scale, or surface oxides from a part by electrolysis. The part is one of the electrodes and the electrolyte is usually alkaline. Electrolytic alkaline cleaning and electrolytic acid cleaning are the two types of electrolytic cleaning.

(1) Electrolytic alkaline cleaning produces a cleaner surface than do nonelectrolytic methods of alkaline cleaning. This operation uses strong agitation, gas evolution in the solution, and oxidation-reduction reactions that occur during electrolysis. In addition, dirt particles become electrically charged and are repelled from the part surface.

(2) Electrolytic acid cleaning sometimes is used as a final cleaning before electroplating. Sulfuric acid is most frequently used as the electrolyte. As with electrolytic alkaline cleaning, the mechanical scrubbing effect from the evolution of gas enhances the effectiveness of the process.

Wastewater generated during electrolytic cleaning includes spent process solutions and rinses. Electrolytic cleaning solutions become contaminated during use due to the dissolution of the base metal and the introduction of pollutants. The solutions typically are batch discharged for treatment or disposal after they weaken. Rinsing following electrolytic cleaning removes residual cleaner to prevent contamination of subsequent process baths.

Electroplating with Chromium involves producing a chromium metal coating on a surface by electrodeposition. Electroplating provides corrosion protection, wear or erosion resistance, lubricity, electrical conductivity, or decoration. In electroplating, metal ions in acid, alkaline, or neutral solutions are reduced on the cathodic