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CHEMEON Trivalent Chromate Conversion and Powder Coating Applications

There are very few chemicals in the metal finishing world today with the versatility to accommodate several different industries and processes and achieve a high performance criterion. A typical application most always requires a stand-alone chemical applicable to a specific process or alloy. This is logical as most chemicals are developed for a specific application, alloy or process to ensure maximum performance results. For example, there are trivalent chromate chemicals specific to cadmium, another for aluminum, and perhaps another for magnesium and cold rolled steel; oftentimes, certain additives are used to bolster and augment the prominent or dominant chemical to further robustness, strength and aesthetics to a given process, but typically, not one trivalent chemical for all the mentioned alloys. An exception to this is CHEMEON TCP-HF, a trivalent chromate chemical developed and patented by the U.S. Navy to replace the carcinogenic hexavalent chromates used around the world in a variety of applications. TCP-HF will be discussed in more detail later in the post.

Briefly, the European Directives, RoHS (Removal of Hazardous Substances) and REACH (Registration, Evaluation, Authorization and Restriction of Chemicals) made it very clear that chemicals that impact health and the environment will be replaced and forbidden in the immediate future. Action was taken years ago by the European Union to rid the world of hexavalent chrome and other toxic and carcinogenic chemicals that damage human health and the environment. Hexavalent chrome is used in a vast array of processes including powder coat and on a myriad of differing alloys with proven and in most cases excellent results. Again, the problem, hexavalent chrome is carcinogenic, toxic and impacts the environment and human health to a disproportionate degree against its alluded benefits.

Hexavalent chromate conversions are still used on a limited basis for those entities that have requested “grandfather status.” There is no doubt this chemical has high performance characteristics and has shown true corrosion resistance, electrical conductivity, adhesion properties and visually appealing aesthetics on a wide variety of metals. For instance, atmospheric corrosion protection on powder coat products is paramount for the longevity and durability of a component part or fixture exposed to extreme

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environmental conditions. Fences and railings, patio furniture, aluminum doors, windows, wheels and virtually hundreds of products used for commercial and military purposes for inside and outside usage may undergo a powder coat process and be exposed to the elements. Application of various finishing treatments for aluminum and other metals has been used for years for corrosion protection and adhesion qualities. Painting and powder coatings are perhaps the oldest finishing processes known to prevent corrosion, enhance durability and give a high degree of aesthetic appeal, and is the purpose of this post today.

Powder coating is described as a finishing application by which a surface is sprayed using dry or liquid pigments (which provide color and opacity) and resins that are electrostatically charged and sprayed onto the surface of a given alloy. The parts are then baked in an oven to cure and fuse into a smooth and durable finish. The adhesion property of the undercoat or primer is paramount to the aesthetics and longevity of the surface being sprayed or powder coated.

A primer is critical to the adhesion qualities of the powder coat on aluminum. There are several chemicals used including hexavalent chromates, iron phosphates and other chemicals of choice. Iron phosphates are known to be inferior to hexavalent chromates and are perhaps not the best choice. Hexavalent chromates dehydrate and breakdown in temperatures in excess of 140ºF. The powder coat is cured at 375ºF and it's purported that the underlying hexavalent chromate is not affected and the integrity of the powder coat surface is intact and robust. As mentioned earlier, hexavalent chromates are on the global removal list and are to be banned.

So, if iron phosphates are an inferior primer for powder coating applications, and hexavalent chromates are deleterious, dangerous, carcinogenic and on the verge of a total global ban, where and what is a viable and performance enhancing product for salt pray exposure, adhesion characteristics and post powder coat surface integrity. An exemplary option may be the NAVAIR QPL-81706B approved CHEMEON TCP-HF, a high performance and benign trivalent replacement for hexavalent chromates, developed and patented by Naval Air Warfare Center (NAVAIR) in Patuxent River, Maryland. CHEMEON was issued the first license to market and sell TCP-

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HF (there are only four licensees in the world). TCP-HF was diligently developed by NAVAIR as other trivalent coatings failed in the field and could not pass all of the performance requirements of neutral salt spray, adhesion or conductivity requirements. TCP-HF passes, for instance, all of the requirements in Military DTL-MIL-5541F and MIL-DTL-81706B

TCP-HF is an ideal undercoat/primer for cured coatings and can be baked for hydrogen relief at 450ºF without loss of performance – unlike hexavalent chromates (certainty is valued when high thermal exposure of an aluminum or magnesium alloy with TCP-HF and subsequent powder coated parts exhibit no loss of performance). CHEMEON TCP-HF is an excellent primer with superior adhesion properties on aluminum and magnesium. TCP-HF is a top choice and used in prominent powder coating companies and exhibit high performance characteristics.

What is CHEMEON TCP-HF?

- Trivalent Chromium (Cr+3) Pretreatment designed for aluminum (and other metals), HF = Hexavalent Free
- Developed and licensed by the United States Navy (NAVAIR)
- Over 2.5 years and 15000 test panels
- Replaces conventional hexavalent chromium (Cr+6) treatments – simple drop-in replacement
- Operates at room temperature with long bath life
- No sealer or a topcoat is required to enhance its performance (as compared to other alternatives)
- Harder deposit than conventional Cr+3
- Electrically conductive and excellent adhesion
- Can be baked at higher temperature without deterioration of performance
- Applicable substrates: galvanized steel, electroless nickel, zinc and zinc alloys, IVD, cadmium, silver, brass, titanium, magnesium, zirconium
- Meets all industry directives/mandates (RoHS, WEEE, ELV, OSHA PEL, REACH)
- MIL-DTL-81706B Type II, 1A (Spray), Class 1A (Corrosion), Class 3 (LER)
- Meet/exceeds: MIL-DTL-5541F, ASTM B921-02, ASTM D3359-97
- QPL Approved May 15, 2006

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QPL-81706B – CHEMICAL CONVERSION MATERIALS FOR COATING ALUMINUM AND ALUMINUM ALLOYS

MIL-DTL-5541F - CHEMICAL CONVERSION COATINGS ON ALUMINUM AND ALUMINUM ALLOYS

- All CHEMEON Pretreatment Chemicals, TCP-HF and Subsequent Powder Coat on 2024-T3 Aluminum Passed the Dry and Wet Tape Adhesion Tests.

  No Pretreated (Alkaline Cleaned) 2024-T3 Aluminum Passed the Dry and Wet Tape Adhesion Tests.

- All CHEMEON Pretreatment Chemicals (TCP-HF & Powder Coat) Had No Sign of Creepage From the Scribed Area and No Blister Development Even After 2148 Hours of Salt Spray With a Rating of 10 per ASTM D1654.*

  No Pretreated Coupons Had a Rating of 6 After 168 Hours of Salt Spray Testing.