

Success Story - Replacement of Hexavalent Chromium Coatings for Electronic Housings and Enclosures

Richard A. Anderson, Stan Paquette, and George Wilkish
M/A-COM, Inc.
1011 Pawtucket Blvd.
Lowell, MA 01853
andersor@tycoelectronics.com

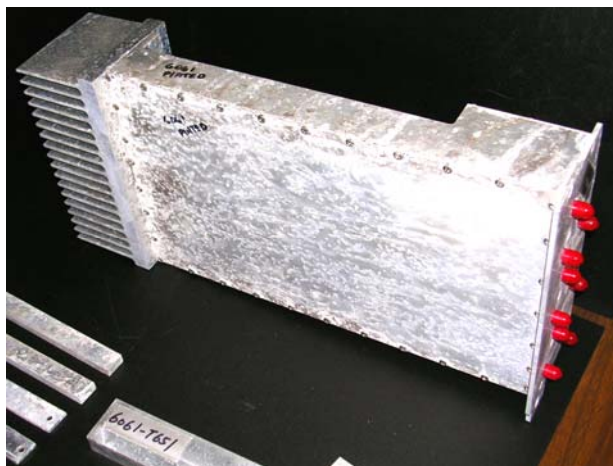
Recent literature and legislation has targeted eliminating or reducing the use of hexavalent chromium. The European Union directive 2002/95/EC called RoHS (Restriction of Hazardous Substances) will ban the use of hexavalent chromium in electronics (housings, chasses, enclosures) 1 July 2006 as an example. Hexavalent chromium is used as a corrosion inhibitor and primer for paint and coating adhesion in many industries, is easy to apply and is inexpensive. Unfortunately it is also health hazard as it is a carcinogen and mutagen.

M/A-COM, Inc. mandated that suitable, effective replacements for hexavalent chromium coatings be found wherever possible for environmental, health, and economic reasons. M/A-COM, Inc. supplies high frequency electronics worldwide. Many M/A-COM electronic housings, chasses and enclosures are made of aluminum and some are used in military and aerospace applications.

The United States Navy, for reasons cited above, developed and patented a trivalent chromium coating, TCP, and TCP application processes. TCP, properly applied to aluminum, meets or exceeds many Military and ASTM specifications. It can also be highly effective on zinc surfaces. TCP is more benign to health and the environment. The US Navy has licensed TCP processes to a number of commercial chemical manufacturers.

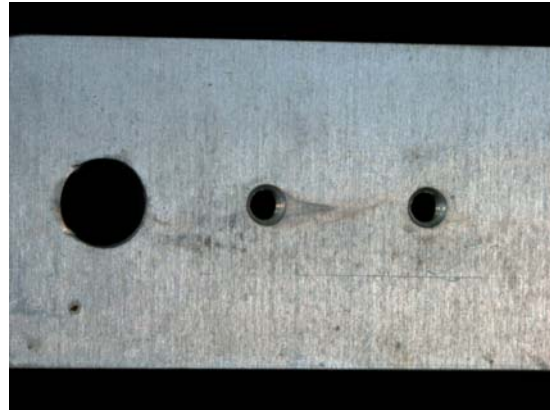
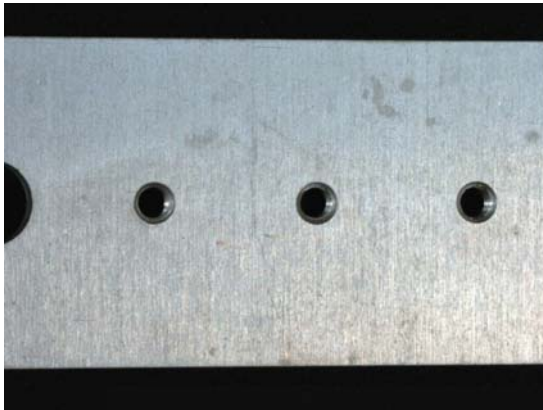
To assess TCP, M/A-COM contacted several TCP licensed suppliers. One, Metalast International, Inc., who distributes Metalast® TCP-HF (Hex-Free), offered to coat and supply coupons of aluminum and zinc plated steel for ASTM salt-spray testing by M/A-COM. Initial tests were very positive with some surfaces surviving over 280 hours. As a result, some aluminum parts and test articles with threaded holes and complex shapes were made, coated locally in a start-up trial, and tested in the same fashion.

Results were less than spectacular with all parts showing some degree of corrosion as seen in the first photograph below. Since the initial coupon tests were so promising M/A-COM, Metalast, and Coating Systems, Inc. of Lowell decided to run a designed experiment based on pre-cleaning alternatives. Working with M/A-COM and Metalast, Coating Systems Inc. set up an improved coating process and provided solutions, samples, and processing conditions data. Solutions and data were analyzed by Metalast and adjustments were made to improve the process.



A new set of complex samples were produced and pre-cleaned various ways at M/A-COM, pretreated, coated with TCP-HF and post treated at Coating Systems, Inc. using the improved

processing parameters. These samples were salt spray tested at M/A-COM using ASTM B117-03 conditions. The below images are typical results from the 168 hour exposure. All parts passed with the worst samples showing only minor evidence of discoloration.



According to Metalast, the TCP-HF process should cost approximately the same as hexavalent chromium in volume applications. It is applied using very little energy and the coating and chemicals pose almost no health hazard if properly handled and disposed.

More testing is in progress as this is being written. OSHA has just reduced the maximum safe exposure limit for hexavalent chromium by over a factor of 10 which will likely spur more interest in alternatives. Concurrently, TURI, the Toxics Use Reduction Institute in Massachusetts has a Five Chemicals Alternatives Assessment Program targeting hexavalent chromium as one of the five health hazards. We feel this is a prime example demonstrating how cooperation among a chemicals supplier, coating application house and end user can develop an effective alternative to a hazardous chemical.

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M/A-COM, Inc.

Richard Anderson, Ph.D.
Telephone: 978-442-5165
FAX: 978-442-5177
Email: andersor@tycoelectronics.com

Tyco Electronics - M/A-COM
1011 Pawtucket Boulevard
Lowell, MA 01851
www.macom.com

Coating Systems, Inc.

Scott Wyman - General Manager
Phone: 978.937.3712
Fax: 978.937.9506
Email: scottw@coatingsystemsgroup.com

Coating Systems, Inc.
90 Phoenix Avenue
Lowell, MA, 01852

METALAST International, Inc.

Joe Radzvilovicz
Senior Vice President, Sales & Marketing|
Tel: 775.782.8324
Fax: 775.782.2498

Email: JRadz@metalast.com
www.metalast.com | www.t-rex.metalast.com