Evaluation of CHO-SHIELD® 2000 Series Coatings Subjected to Salt Fog Exposure

Prepared By: Philip M. Lessner
Senior Research Chemist

Chomerics, div. of Parker Hannifin / 77 Dragon Ct. / Woburn, MA 01888 / 910 781-935-4850
Parker Hannifin PLC / Chomerics Europe / Parkway, Globe Park Estate /
Marlow, Bucks, England SL7 1YB / (44)1628 404000

1 SUMMARY

Chomerics CHO-SHIELD 2001 and 2002 conductive flange coatings were applied to 2024-T3 aluminum plates, and then subjected to 500 hours of ASTM 8117 salt fog exposure.

Examination of test specimens showed that elevated-temperature-cured 2001 coating provided excellent protection of the aluminum substrate even after 500 hours of salt fog exposure. Reasonably good corrosion protection was provided by room-temperature-cured 2001 coating after 500 hours of salt fog.

CHO-SHIELD 2002 coating, which is generally recommended for composites or as a 2001 field repair coating, does not pass a 500-hour ASTM 8117 salt fog exposure test on 2024-T3 aluminum. Based on observations during the salt fog test, it is estimated that 2002 coating would pass a 100-130 hour salt fog test on 2024-T3 aluminum.

2 INTRODUCTION

CHO-SHIELD 2001 coating is intended primarily for use as an aluminum flange treatment when conductive surfaces must be maintained in corrosive (salt fog or wet) environments. It consists of a stabilized copper filler particle in a urethane binder. Additional protection of the aluminum flange is provided by a chromate-based inhibitor.

CHO-SHIELD 2002 coating is intended for use on non-metallic substrates (e.g., plastic, or carbon-polymer composites) and as a field repair compound for CHO-SHIELD 2001 coating. It does not contain a chromate inhibitor and therefore does not provide the same level of protection of aluminum substrates as 2001 coating.

The objective of this test program was to determine whether these CHO-SHIELD 2002 . coatings could pass a 500-hour ASTM 8117 salt fog exposure test on a corrosion-prone aluminum alloy, and whether cure temperature affects the degree of corrosion protection afforded by the coatings.

3 TEST METHOD

CHO-SHIELD 2001 and 2002 coatings were sprayed onto 2024-T3 aluminum test pa which had been alkaline etched and chromate conversion coated per MIL-C-5541, Class 3 . different batches of conversion coated test p: were used, in an attempt to determine whether variability of the conversion coating we affect the salt fog results.

Both elevated-temperature (E.T.)-cured samples (30 min @ 250 ° F) and room-temperature (R.T.)-cured samples (7days) were included in the test program. All samples were edge-sealed with MIL-P-23377 primer and an epoxy topcoat.

Samples were placed in a tray rack and subjected to 500 hours of ASTM 8117 salt fog plates were examined for coating blisters during and after salt fog exposure.

4 RESULTS

No difference in performance was noted between the different batches of conversion coatings.

Figure 1 is a photograph of the E.T.-cured samples of CHO-SHIELD 2001 coating after 500 hours of salt fog exposure. Only one sample showed minor blistering; the other three samples showed no blistering. Figure 2 is a photograph of the R.T.-cured CHO-SHIELD 2001 coating samples. Only one or two blisters per test specimen were noted.

Figures 3 is a photograph of the E.T.-cured samples of CHO-SHIELD 2002 coating, after 500 hours in salt fog. All test panels show blistering. Figure 4 is a photograph of the R.T.-cured CHO-SHIELD 2002 samples. Blistering on these samples was severe. Observations during the test indicated that within 168 hours, some blisters appeared on the E.T.-cured 2002 samples, and many blisters appeared on the R.T.-cured samples. These observations substantiate previous testing which indicated that the CHOSHIELD 2002 coating will withstand about 100-130 hours of ASTM 8117 salt fog exposure on 2024-T3 aluminum.

5 DISCUSSION

The degree of substrate protection offered by a coating is determined by: (1) the permeability of the coating to water, to ions (Na+, Cl-), and to oxygen; (2) the presence of protective inhibitors; and (3) the degree of adhesion of the coating to the substrate. In this study, the adhesion of all coatings to their substrates was determined to be good before starting the salt fog exposure.

Differences in permeability are responsible for the differences in substrate protection between the E.T-. and R.T.-cured coatings. The R.T.-cured coating is less densely cross-linked. Lower cross-link density leads to greater permeability and substrate protection.

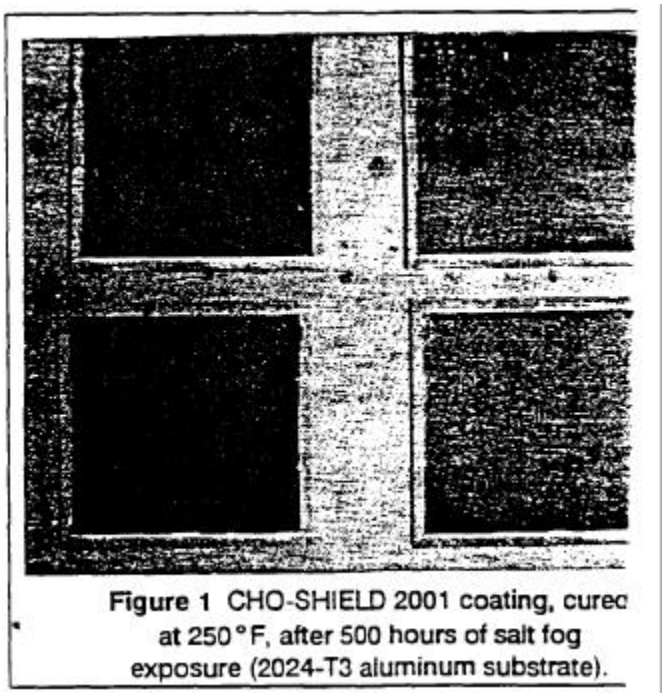

Figure 1 CHO-SHIELD 2001 coating, cured at 250 °F, after 500 hours of salt fog exposure (2024-T3 aluminum substrate).

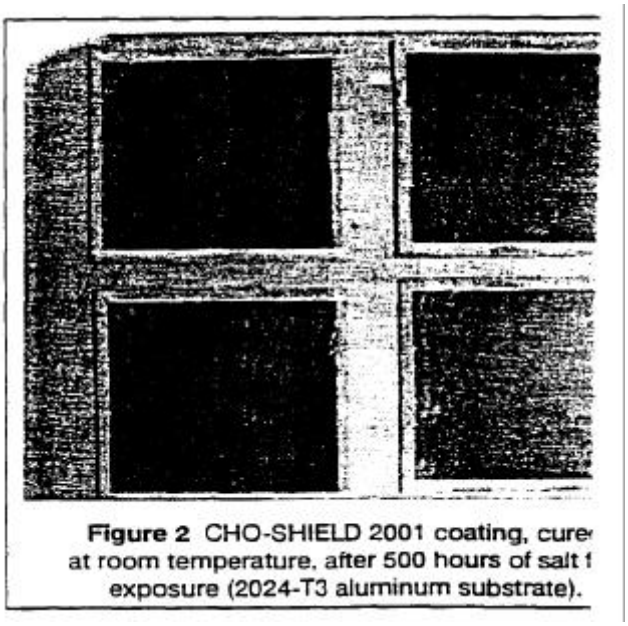

Figure 2 CHO-SHIELD 2001 coating, cured at room temperature, after 500 hours of salt fog exposure (2024-T3 aluminum substrate).

The CHO-SHIELD 2001 coating contains zinc potassium chromate, which is a potent inhibitor of aluminum corrosion. Water penetrating through the coating leaches the chromate out of the binder. The inhibitor protects the aluminum even in the presence of NaCl solution at the coating-aluminum interface. The protective action of the inhibitor is responsible for the dramatic difference in performance between the R.T.-cured CHO-SHIELD 2001 and 2002 coatings. Even though the R.T.-cured 2001 coating is as permeable as the 2002 coating, less blistering occurs because of the protective effect of the chromate.

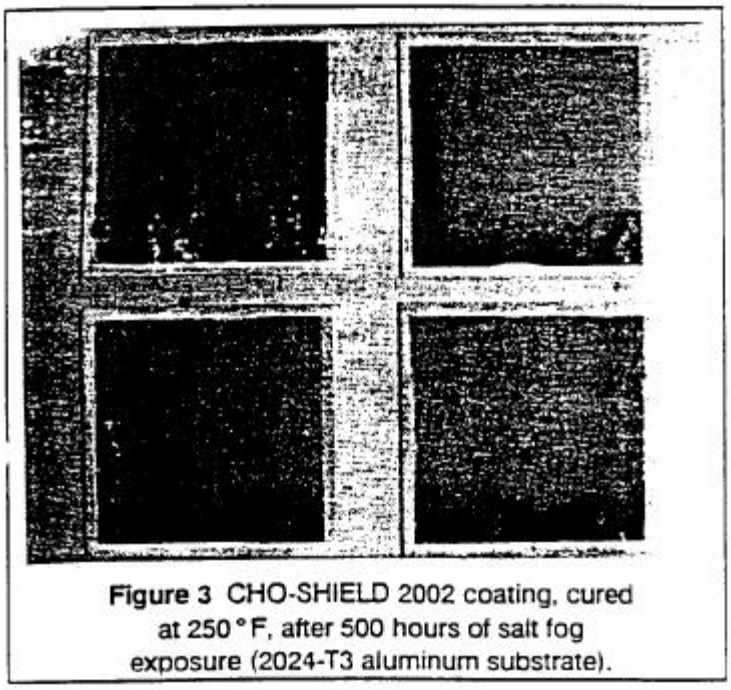

Figure 3 CHO-SHIELD 2002 coating, cured at 250 °F, after 500 hours of salt fog exposure (2024-T3 aluminum substrate).

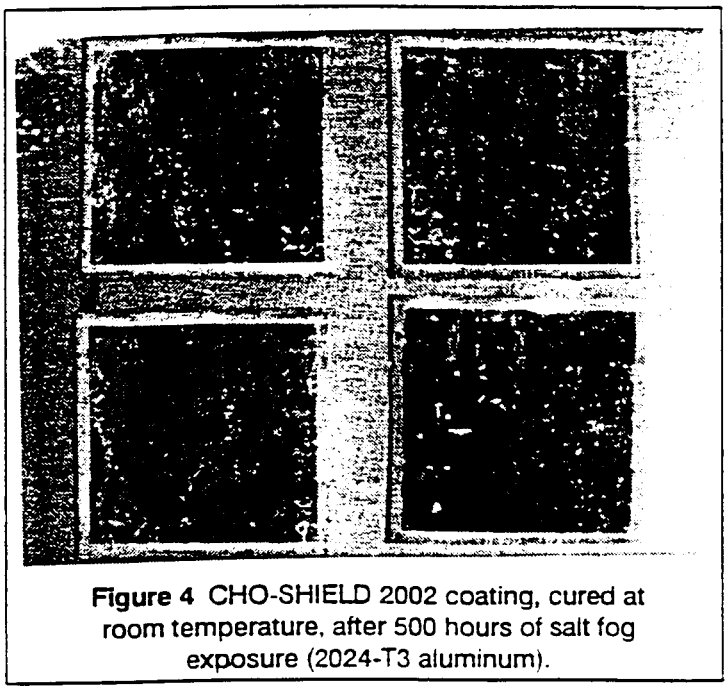

Figure 4 CHO-SHIELD 2002 coating, cured at room temperature, after 500 hours of salt fog exposure (2024-T3 aluminum).

6 **CONCLUSION**

Both CHO-SHIELD 2001 and 2002 coatings offer a substantial degree of protection to 2024-T3 aluminum exposed to ASTM B1 17 fog. There is a significant difference in protection offered by the two coatings. This difference is evident with R.T.-cured samples, in which the permeability of the urethane binder is high and chromate inhibitor in CHO-SHIELD 2001 is important in corrosion protection.