# Evaluation of Corrosion Resistant Non-Chromated Coating Systems for Aircraft Aluminum Alloys

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The Air Force requires development of environmentally compliant non-chromate aircraft coating systems that meet or exceed current corrosion protection capabilities. The current Air Force corrosion inhibition mechanism for coatings relies heavily on the use of Cr(VI) compounds in the form of strontium or barium chromate, which are incorporated into both the surface pretreatment and the primer. These corrosion inhibitor systems are very effective, but Cr(VI) is a known carcinogen that is expected to be banned from use in the near future.

To address this problem, a number of non-chromated pretreatments and primers have been investigated over the past several years. Previous testing of non-chromate technologies has focused on either replacement of the chromate conversion coating (CCC) pretreatment or the MIL-PRF-23377 chromated epoxy primer system with a non-chrome substitutes separately. Several non-chromated pretreatments such as PreKote (Pantheon Chemical Corp.), Boegel (AC Technology, Inc.), and AFRL's Self-assembled Nanophase Particle (SNAP) have been proposed and preliminary test results suggest a possible effective replacement for CCC[1-3]. For example, a coating system that incorporated the SNAP surface treatment with the standard chromated primer exhibited equivalent corrosion protection as the current fully chromated system.[3]

However, these pretreatments have not yet been tested with non-chromate primers to evaluate the corrosion resistance in a fully non-chromated system. Another possible consideration is an experimental non-chromated magnesium rich primer (North Dakota State University) that does not require a chromated pretreatment, but does require the use of an advanced performance polyurethane topcoat (Defthane ELT). This system can potentially eliminate the need for chromated components and be incorporated into the coating system by providing adequate corrosion and weathering resistance.

The objective of this work was to compare corrosion resistance of fully non-chromated systems against the chromated standard and develop a relative ranking of performance between them for use in subsequent developments. Corrosion resistance[4] was evaluated by both ASTM B117 Salt Spray and Electrochemical Impedance Spectroscopy (EIS). The chromated control standard consisted of CCC, MIL-PRF-23377 epoxy primer and APC polyurethane topcoat. The results identify the non-chromated coating system(s) that perform equally or better than the current chromated standard coating system.

References:
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