

Corrosion Prevention and Abatement Compounds for Boldly Exposed and Occluded Regions on Aircraft

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Successful implementation of corrosion management requires a range of technologies. Corrosion prevention compounds (CPC) are materials that can both delay new corrosion sites from forming and, more importantly, suppress corrosion that has initiated. It is important to recognize that CPC are applied as a post-production treatment to provide cost-effective, temporary corrosion protection and to control existing corrosion.

CPC have been used on aircraft for many years as a relatively inexpensive method of combating corrosion. One of the main advantages of using CPC is that little or no preparation of the affected site is required before application. Consequently, these CPC can be used at the field maintenance level instead of requiring application at the depot. Thus, corrosion can be suppressed early on, before substantial structural damage can occur. CPC are not meant to replace high-performance coating systems, but they can be effective for on-site repair of coated regions that may have been damaged or degraded, for extending the service life of a coating, and for protecting regions of aircraft that did not receive corrosion prevention treatments during original manufacture. CPC can, in principle, serve a key function as a component of a corrosion management strategy.

Effective CPC function via one or more of four mechanisms: (a) blocking film formation, (b) kinetic inhibition of surface reactions, (c) water displacement, or (d) local electrolyte modification. Film formers produce a covering on the surface to be protected that prevents the formation of an aqueous phase at the metal surface. Without such a phase, the electrochemical reactions required for corrosion cannot occur. Inhibitors that directly impede the electrochemical kinetics can be added to CPC. Some CPC seek to actively remove moisture from a metal surface, with this water displacement serving to stop any corrosion that could occur. Finally, CPC can function by altering the chemical conditions of any aqueous phase that does form at a surface by, for example, buffering the pH to a less aggressive range or reacting with aggressive species that may be present.

In this project, we will develop and test effective corrosion prevention and abatement compounds for both boldly exposed and occluded regions on aircraft that can be applied cost-effectively at both the field and depot levels.