Laboratory Evaluations of Corrosion Prevention Compounds for Aircraft

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Corrosion prevention compounds (CPC) are materials that can both prevent new corrosion sites from forming and, more importantly, suppress any 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 [1]. Therefore, it is important to have a proper method for CPC performance assessment and to understand how CPC function when put into use. The works done in this project are not only useful for CPC screening and assessment for typical application but also will provide sights for new CPC development.

The first part of current experiments includes laboratory evaluation of four different CPC (Amlguard, Dinitrol® AV30, Dinitrol® AV8 and LPS3) by electrochemical impedance spectroscopy (EIS) since EIS has been successfully used to study organic coatings on metals. The information obtained by EIS will provide complementary information to that obtained by traditional techniques for characterizing the behavior of organic coatings in corrosive environment [2]. The experiment results indicate that CPC do provide protection on both pristine and precorroded AA2024-T3 and AA7075-T6 samples under constant and alternate immersion. EIS also showed it application in assessing CPC by showing correlation between low frequency impedance and CPC failure indicated by visual check results of CPC treated samples.

The second part of current experiments was to study the surface property measurement of four different CPC. Also, the wicking ability of CPC into dry, wet and CPC treated lap joints was measured by incorporating optical fiber sensor into lap joints. Experiments showed that the ability of different CPC to wick into wet and dry lap joints was predicted by fundamental surface chemistry measurements. The surface polarity of the CPC appeared to dominate the wetting and moisture displacement capability of CPC; a low surface tension promotes spreading whereas high surface polarity promotes water displacement from oxidized surfaces.

Future work will investigate the accelerated corrosion method for laboratory CPC performance evaluation, for example, speeding the corrosion process by putting intentional scratches on CPC treated samples. The fundamental information for understanding CPC performance, such as inherent physical properties including water emulsification and surface tension, will be investigated. Other new CPC will be used for results comparison with those will be obtained in S&K techniques, Dayton, Ohio.

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[1] B. Hinton, et al., 4th International Aerospace Corrosion and Control Symposium, Jakarta, Indonesia, June 1996

[2] J. A. Gonzalez, E. Otero, A. Bautista, E. Almeida, M. Morcillo, "Use of electrochemical impedance spectroscopy for studying corrosion at overlapped joints", *Progress in Organic Coatings*, 33, 61, (1998)