Role of EIS in Materials and Coatings Selection for NASA's Launch Facilities

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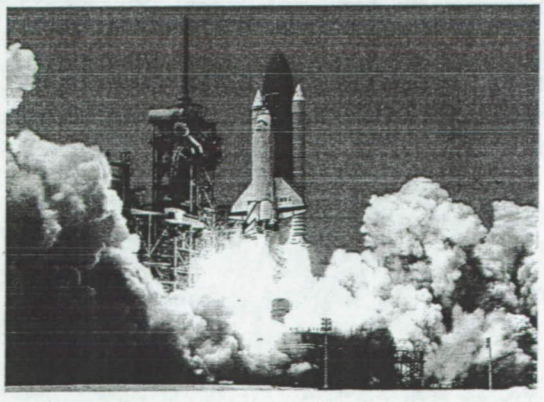
Corrosion studies began at NASA's John F. Kennedy Space Center (KSC) in 1966, during the Gemini/Apollo Programs, with the evaluation of long-term anti-corrosion coatings for carbon steel structures. NASA/KSC's Atmospheric Exposure Test Site was established at that time on the beach near the launch pad. In the years that followed, numerous studies at the site have identified materials, coatings, and maintenance procedures for launch hardware and equipment exposed to the highly corrosive environment at the launch pad. The atmosphere at the launch pad is highly corrosive due to the proximity of the Atlantic Ocean, high heat from rocket exhaust, and since the introduction of the Space Shuttle, the acidic combustion products of the Solid Rocket Boosters (SRBs). Currently, NASA/KSC maintains about $2 billion worth of unique equipment and facilities, not including the orbiters, each valued at about $1.8 billion. Among the items: two launch complexes, two crawler transporters, three mobile launch platforms, and specialized testing equipment. Atmospheric exposure provides very valuable data but it takes a long time and relies on human visual inspection. NASA Technical Standard for Protective Coatings requires 18 months of good performance at the Atmospheric Exposure Test Site for preliminary approval and continued good performance for 5 years for final approval of a coating system.

The use of electrochemical impedance spectroscopy (EIS) was introduced at KSC in 1989 as a supplement to the traditional dc electrochemical techniques and atmospheric exposure studies. This paper presents and overview of several projects in which EIS was used in order to select materials and coatings to be used at NASA's launch facilities [1-2].

References

1. L.M. Calle and L.G. MacDowell, "35 Years of Corrosion Research at the Kennedy Space Center," CORROSION/2003, Paper No. 03208 (Houston, TX: NACE 2003).
2. L.M. Calle and L.G. MacDowell, Proceedings of The Fifth International Symposium on Electrochemical Impedance Spectroscopy, EIS 2001, p. 199, Trento, Italy, 2001.



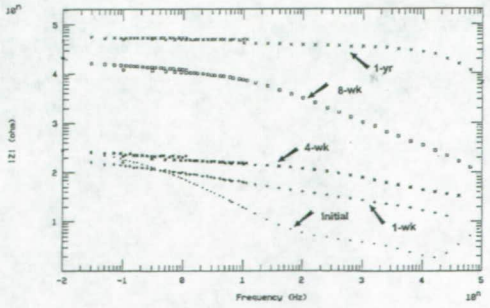


Figure 1. Space Shuttle Launch.

Figure 2. Bode Plots for Zinc Primer