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Author: Dr. Luz Calle
NASA, United States

CORROSION CONTROL IN THE LAUNCH ENVIRONMENT

Abstract

Corrosion is the degradation of a material that results from its interaction with the environment. The marine environment at NASA's Kennedy Space Center (KSC) has been documented by ASM International (formerly American Society for Metals) as the most corrosive in the United States. With the introduction of the Space Shuttle in 1981, the already highly corrosive conditions at the launch pads were rendered even more severe by the 70 tons of highly corrosive hydrochloric acid that were generated by the solid rocket boosters. Numerous failures at the pads are caused by corrosion of stainless steels, rebar corrosion, and the degradation of the refractory concrete. The structural integrity of launch hardware and ground support equipment is critical to the success, safety, cost, and sustainability of human spaceflight operations. As a result of fifty years of experience with launch and ground operations in a natural marine environment that is highly corrosive, NASA's KSC is a major source of corrosion control expertise in the launch environment. Corrosion studies began at KSC in 1966 during the Gemini/Apollo Programs with the evaluation of coatings for the corrosion protection of carbon steel. NASA's KSC Beachside Corrosion Test Site was established near the launch pads at that time. The site has provided over 45 years of technical information on the long-term corrosion performance of many materials. In the years that followed the introduction of the Space Shuttle Program, numerous studies were conducted to identify materials, coatings, and maintenance procedures for launch hardware and equipment exposed to the highly corrosive environment of launch pads. Effective corrosion control has many challenges. One important challenge involves its detrimental impact on humans and the environment. This challenge has motivated the development of new corrosion control strategies that are more effective and environmentally friendly. Strategies for improved corrosion protection and durability can have a huge impact on the economic sustainability of human spaceflight operations. This paper provides an overview of the corrosion challenges associated with launch and ground support equipment for human spaceflight operations as well as new strategies for corrosion control that are currently under development.