

Hexavalent Chromium IV-Free Primer Development

Project Manager(s)/Lead(s)

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Sponsoring Program(s)

Human Exploration and Operations Mission Directorate
Space Launch System Advanced Development
SLS Spacecraft Payload Integration and Evolution
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Project Description

Primer materials provide corrosion protection for metal parts as well as an increased adhesion between metallic substrates and thermal protection systems (TPSs). Current primers for use in cryogenic applications contain hexavalent chromium. This hexavalent chromium provides excellent corrosion protection even in a cryogenic environment, but it is a carcinogen that requires special equipment and waste control procedures to use. The hazardous nature of hexavalent chromium makes it an obsolescence risk in the future.

This study included two phases of evaluation. Thirteen primers were initially identified as candidates and twelve of those primers were tested in phase 1. Four of the best performing candidates from phase 1 continued into phase 2 testing. Phase 1 testing consisted mostly of liquid constituent and physical property testing. Cryoflex and salt fog testing were included in phase 1 because of their importance to the overall success of a candidate material. Phase 2 consisted of physical, thermal, and mechanical properties for nominally processed and fabricated specimens.



Coating applications.



Hexavalent chromium-free primer panels.

Anticipated Benefits

Benefits of this project include identified replacement material(s) for chromate-containing primers that meet the typical demands of space launch vehicles, reduced risk of schedule and budget impacts due to potential tightening restrictions and regulations governing the use of chromate-containing primers, and identified potential technical risks and shortcomings associated with the usage of nonchromate-containing primers currently available.

Potential Applications

Primers of this type may be used on the following applications: Space Launch System elements, cryogenic pressure vessels in other launch vehicles, test articles and testing support equipment, commercial crew and commercial resupply for International Space Station support, satellite launch and support equipment, and ground support and launch support equipment.

Notable Accomplishments

All four primers tested in phase 2 performed well on thermal and mechanical tests. While none of the hexavalent chromium-free primers passed the 1,000-hr, salt-fog corrosion testing, two of the candidates had only minor defects. The top-performing primers for corrosion resistance were PRC-Desoto CF/CA 7502 with PPG Surface Pretreatment EAP-9 and Sherwin Williams CM0483787.

References

EM41-TP052, “Test Plan for SLS ADO-05 Hexavalent Chromium Free Primer for Cryogenic Applications.”

EM41-TR052, “Phase 1 and 2 Test Report for SLS ADO-05 Hexavalent Chromium Free Primer for Cryogenic Applications.”