Electrocoat Process for Non-Chromate Primers in DoD Manufacturing

ESTCP Project: WP-201010

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**Report Documentation Page**

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Standard Form 298 (Rev. 8-98)  
Prescribed by ANSI Std Z39-18
• Electrocoat Process Description
  – Electrocoat “Basics”
  – Performance review

• Overview of ESTCP Program
  – Scope of Project
  – Project Tasks
Electrocoat Applications
Anodic Electrocoat

- Waterborne coating
- Negatively charged paint particles; applied with electrical current
- Lower temperature cure: 30 minutes metal at 200°F
- Chemistry and cure requirements are uniquely suited for aerospace aluminum.
Electrocoat System

- Alkaline clean
- Rinse
- De-oxidizer
- Rinse 1st
- Rinse 2nd
- RO Rinse
- Fully cured for 30 min @ 200°F metal temp
- Oven
Why Electrocoat for Aerospace?

- Environmental, Health and Safety Considerations
  - Aqueous based
  - Minimal waste discharge – closed loop process
  - Minimal exposure of workers to hazardous materials

- Productivity / Efficiency
  - Automated process – increased productivity
  - Virtually 100% materials utilization
  - Immediate part handling after thermal cure (30 minutes metal @ 200 ºF)
    - Do not have “dry to touch”, “dry to tape”, “dry to fly” restrictions

- Application / Performance
  - Uniform film across entire surface including recessed areas
  - Excellent barrier / corrosion resistance properties
Electrocoat Performance

• Requirements of MIL-PRF-23377
  – Corrosion Resistance
    • Salt Spray
    • Filiform
  – Adhesion
  – Flexibility
  – Water Resistance
  – Solvent Resistance
  – Fluid Resistance

➤ SO₂ Salt Fog testing (ASTM G 85 Annex 4)

*Electrocoat passes all performance specifications*
Electrocoat Performance
Galvanic Assemblies

After 500 hrs B117
Cr-free Ecoat over CrCC
MIL-PRF-23377 Type I Class N over CrCC

After stripping off primer
• Beach exposure – 18 months at Kennedy Space Center

Chromium spray primer over Cr conversion coat

10 rating

Cr-free Ecoat over Cr CC

9 rating
(initial rating was 9 prior to exposure)

Cr-free Ecoat over TCP

10 rating
• Demonstration and validation of a novel, non-chromated, environmentally friendly, electrodeposited primer.
  - The primers will be tested and demonstrated with previously transitioned “green” metal finishing solutions

• Depot level rework will be used to validate the performance of the proposed coating system.

• Environmental, productivity and life cycle cost benefits of the technology will also be evaluated.
The proposed demonstration and validation project will be structured in two phases:

- **Phase I- Task 1: Proof of concept test matrix**
  - Performance over various substrates will be evaluated
  - Multiple surface treatments
    - Conversion coats (MIL-DTL-81706 Type I and II)
    - Anodized (MIL-A-8625 IIB)
  - Panels topcoated with MIL-PRF-85285 Type IV coating

Upon completion of testing, a Go/ No Go decision will be based upon coating performance and program office buy-in
Technical Approach

• Phase II- Task 2: Installation of an electrocoat system at FRC-Southwest North Island
  
  – System will include a 2000 gallon electrocoat tank and rinse stages to enable coating parts and assemblies up to several feet in diameter.

  – The electrocoat system will be installed in several unused tanks in the cleaning shop

  *If material is qualified, system can accommodate full-scale production*
Technical Approach

Layout of existing cleaning shop tanks at North Island

Proposed site for electrocoat system

Existing hoist can be used
• Phase II/ Task 3: Selection, coating, and evaluation of various test parts
  
  – Focus on components such as wheel assemblies and seat tracks to be installed on Air Force and Naval aircraft.
  
  – Performance will be tracked relative to hexavalent chromated spray controls.
  
  – Electrocoat performance productivity will be measured in terms of material usage, labor costs, hazardous waste volumes for life cycle calculations.

Representative test parts: wheel assemblies and seat track components
Acknowledgements

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