Electrocoat Process for Non-Chromate Primers in DoD Manufacturing

ESTCP Project: WP-201010

Presenter: Thor Lingenfelter
PPG Industries, Inc.
**Electrocoat Process for Non-Chromate Primers in DoD Manufacturing**

**PPG Industries, Inc,** One PPG Place, Pittsburgh, PA, 15272

**ASSETSDefense 2011: Sustainable Surface Engineering for Aerospace and Defense Workshop, February 7-10, 2011, New Orleans, LA. Sponsored by SERDP/ESTCP.**

1. **REPORT DATE**
   FEB 2011

2. **REPORT TYPE**

3. **DATES COVERED**
   00-00-2011 to 00-00-2011

4. **TITLE AND SUBTITLE**

5. **CONTRACT NUMBER**

6. **AUTHOR(S)**

7. **PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)**
   PPG Industries, Inc, One PPG Place, Pittsburgh, PA, 15272

8. **PERFORMING ORGANIZATION REPORT NUMBER**

9. **SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)**

10. **SPONSOR/MONITOR’S ACRONYM(S)**

11. **SPONSOR/MONITOR’S REPORT NUMBER(S)**

12. **DISTRIBUTION/AVAILABILITY STATEMENT**
    Approved for public release; distribution unlimited

13. **SUPPLEMENTARY NOTES**
    ASETSD 2011: Sustainable Surface Engineering for Aerospace and Defense Workshop, February 7-10, 2011, New Orleans, LA. Sponsored by SERDP/ESTCP.

14. **ABSTRACT**

15. **SUBJECT TERMS**

16. **SECURITY CLASSIFICATION OF:**

17. **LIMITATION OF ABSTRACT**
    Same as Report (SAR)

18. **NUMBER OF PAGES**
    15

19. **NAME OF RESPONSIBLE PERSON**

---

*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
Rinse 1st
Rinse 2nd
RO Rinse

Fully cured

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
Electrocoat Performance

- 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
• **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*
Layout of existing cleaning shop tanks at North Island

Proposed site for electrocoat system

Existing hoist can be used
Technical Approach

- 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

• ESTCP
  – Bruce Sartwell

• ASETSDdefense
  – Keith Legg

• USAF Corrosion Office
  – 2nd Lt. Doug Banning- PI
  – Mark Foley
  – SMSgt Donald S. Ward
  – Corey Bliss (AFRL)
    • FA8650-5-C-5010 Task 8

• NAVAIR
  – Julia Russell- PI
  – Bill Nickerson
  – Craig Matzdorf
  – Luc Doan

• PPG
  – Duane Utter
  – Robin Peffer
  – Gary Orosz