Introduction to Corrosion Control and Coatings

Coating Defects, Failures, and Inspection

Topics

- Consequences of coating failure
- Common coating failures and defects
- Quality assurance and inspection
Protective Coatings

- Used on systems for corrosion protection
- All coatings will break down over time
- Service life can be extended by performing maintenance painting once deterioration is identified

Premature Coating Failure

- Failures that occur before the anticipated service life is over
- Can be caused by:
  - Improper surface preparation
  - Improper coating application procedures
  - Improper coating system selection
  - Mission environment
  - Storage of aircraft
  - Geographic location of aircraft
  - Location on aircraft
**Common Coating Failures and Defects**

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**Delamination**

- Results from loss of adhesion between the substrate and coating OR between coats

**Common Causes**

- Poor surface preparation
- Intercoat cleanliness
- Exceeding overcoating times
- Incompatibility of topcoat and primer
### Blush

- Haze or oily residue on the surface of a coating
- Blush will affect adhesion of topcoat

#### Common Causes

- High humidity or cold temperatures during curing of epoxy coatings
- Intensified by cool temperatures and increased coating thickness

### Sags/Runs

- Downward movement of paint soon after application on vertical surfaces

#### Common Causes

- Over application
- Improper stand-off distance
- Improper equipment settings and technique
- Improper viscosity
- Poor workmanship
- Temperature/humidity
**Orange Peel**

- Textured appearance; surface of paint film resembles the skin of an orange

**Common Causes**

- Poor application techniques
- Improper equipment settings
- Too high or low of pressure
- Incorrect solvent blend

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**Pinholes/Holidays**

- Formation of tiny holes in wet paint film during application and drying due to air/gas bubbles, which burst
- Bursting bubbles form small craters or holes, which fail to coalesce before the film dries

**Common Causes**

- Recoated too early
- Solvent or air entrapment
- Incorrect spray application
Fisheyes
- Small crater-like openings that form during application or shortly after

Common Causes
- Poor surface preparation
- Contamination
- Oil on the surface
- Oil in spray line

Wrinkling
- Wavy lines that appear in the paint film during different stages of coating application

Common Causes
- Excessive application of coating
- Actual temperatures exceeding or going below application range
- Overcoating before previous coat has sufficiently hardened
- Incorrect coating viscosity
Aerospace Engineer
Coating Defects and Failures

Dry Spray
• A rough or uneven finish in the paint film, where particles are not fluid and flowing together

Common Causes
• Improper application technique
  • Too far of a stand-off distance
  • Insufficient atomization

Quality Assurance and Inspection
• The quality of a coating application cannot be determined following the job and therefore in-process quality assurance is critical
Role of a QA/Supervisor

- The QA/supervisor can play a key role in helping to prevent premature coating failure
- Qualified inspection personnel can significantly reduce the probability of failure
- The QA/supervisor:
  - Identifies deficiencies as they arise
  - Will work with maintainer personnel on corrective actions

Pre-Job Meetings

- Review technical guidance details
- Establish inspection checkpoints
- Review safety issues
- Clarify ambiguities and conflicts with specification and other project documents
Coating Inspection Plan

- Job-specific document
- Systematically lists inspection hold points, test methods, and acceptance criteria for each procedure in each phase of the project work in sequence
- Developed in coordination with maintainer work plan for the overall job

Common Hold Points for Inspection

- Pre-surface preparation
- Post-surface preparation
- Coating application
- Post-coating application
- Post-curing of coating
- Final inspection
Inspection Tools

- Examples
  - Ambient Conditions – Electric or sling Psychrometer
  - Adhesion – Portable Pull-off adhesion testers
  - Dry Film Thickness – Type 2 DFT gage
  - Wet Film Thickness – WFT comb

Coating Defects, Failures, and Inspection Summary

- There are many reasons why coatings may fail
  - DFT and adhesion are key factors.

- In-process Quality Assurance minimizes the probability of failure

- Pre-job meetings are essential to the planning process while inspection is a key component in job quality monitoring.

- Inspection hold points are critical periods during the coating project.
Final Thoughts

- Corrosion can have a significant impact on system maintenance costs, availability, and safety
- There are many factors that influence the corrosion performance of a system
- Design, materials selection, coatings, and cathodic protection are the primary methods used to control corrosion

Course Summary

- Corrosion Basics
- Fundamentals of Corrosion Control
- Surface Preparation for Coatings
- Coatings and Coating Types
- Coating Application and Safety
- Coating Defects and Inspection