

Materials Tip



Materials Engineering Branch

Quality of Anodic Coatings			
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Anodizing of aluminum alloys is performed per MIL-A-8625 on a wide variety of Goddard spacecraft components. The advantages of this type of coating are numerous: excellent wear resistance, corrosion resistance, and adhesion. Anodic coatings can be dyed with a variety of colors and since the anodic film is nonconductive, it can be used for electrical insulation purposes (see TIP 097).

SUMMARY OF ANODIZE TYPES

Type I, chromic acid anodizing, possesses good chemical resistance but poor abrasion resistance. Type II anodize should be used instead of Type I when improved corrosion - and and/or abrasion resistance is required.

Type II is the preferred general purpose anodic coating and is formed in a sulfuric acid bath. The thickness range is 0.07 to 1.0 mil and the coating can be dyed (non-dyed = Class 1; dyed = Class 2). Sealing controls the corrosion resistance of the coating and is performed after dyeing by immersion in an appropriate bath--often nickel acetate or boiling water.

Type III anodize (hard coat) provides excellent wear resistance when used non-dyed and unsealed. It is applied in a 0.5 to 4.5 mil thickness range and is often lapped or honed to size to remove a thin relatively soft surface layer.

QUALITY TESTS FOR ANODIC COATINGS

MIL-A-8625 requires that the vendor perform process control tests on witness samples on a monthly basis and quality conformance tests on items from each 8 hour production run.

Process Control Tests:

- minimum coating weight for Types I and II
- coating weight or thickness for Type III
- salt spray corrosion resistance test for Types I and II
- light fastness resistance for dyed Type I and II coatings
- abrasion resistance for Type III

Quality Conformance Tests:

- visual for coating quality
- part dimensional compliance per drawing

While these tests will ensure high quality anodic coatings if they are performed properly, there are several tests that can be used upon receipt as a verification inspection for flight anodized parts:

Appearance--The most common quality control test is visual inspection. The coating should be smooth and uniform in appearance, free from smudged or powdery areas, adherent, and bright depending on the base metal finish.

Adherence --Tape lift tests can be performed on anodic coatings to determine the size and frequency of particles that are removed. A good anodic coating should not release particles. The coating can also be repeatedly rubbed with swabs dampened with alcohol, hexane, or deionized water. Dye coloration or particles should not be observed.

Sealing Effectiveness--Optimized corrosion resistance occurs when sufficient sealing time is employed. Well sealed coatings will show less than a 30 mg/square decimeter weight loss in the phosphoric/chromic acid test per ISO 3210. Approximately 2.8 inch square witness samples are required.

Coating Thickness--An eddy current thickness meter rapidly and accurately indicates if the coating is within the proper thickness range at numerous locations on the part.

Metallographic--For insulator applications, metallographic examination of the surface of parts at 400X magnification will nondestructively reveal the tightest surface cracks. Destructive evaluation indicates porosity, entrapped phases, thickness, and cracking.

Tests that are required by MIL-A-8625 on a monthly basis--such as salt spray or abrasion resistance--can be performed on a specific lot of flight hardware parts if desired.

CLEANING

Isopropyl alcohol (200 proof), reagent grade hexane or heptane, or deionized water are suitable. Avoid alkaline (Sparkleen, etc.) or acidic cleaners.