SAE Aerospace
An SAE International Group

AEROSPACE MATERIAL SPECIFICATION

SAE AMS2482 | REV. D

Issued 1989-04
Reaffirmed 2006-04
Revised 2010-01

Superseding AMS2482C

Hard Anodic Coating on Aluminum Alloys Polytetrafluoroethylene (PTFE)-Impregnated or Codeposited

RATIONALE

AMS2482D results from a Five Year Review and update of this specification.

1. SCOPE

1.1 Form

This specification establishes the requirements for a hard aluminum oxide coating, impregnated or codeposited with polytetrafluoroethylene (PTFE) on aluminum alloys.

1.2 Application

This process has been used typically to increase, by the formation of a dense, PTFE-impregnated aluminum oxide or codeposited PTFE-aluminum oxide layer, surface hardness and resistance to abrasion and corrosion of aluminum alloy parts containing, in general, less than 5% copper or 8% silicon or a total of 8% of both. See 8.6.

1.3 Classification

The processes covered by this specification are classified as follows:

Type 1 - PTFE-impregnated aluminum oxide
Type 2 - Codeposited PTFE and aluminum oxide

1.3.1 If a specific type is not specified, Type 1 shall be supplied.

1.4 Safety - Hazardous Materials

While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: http://www.sae.org

SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/AMS2482D

2.1 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM B 117 Operating Salt Spray (Fog) Testing Apparatus

ASTM B 244 Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy-Current Instruments

ASTM B 487 Measurement of Metal and Oxide Coating Thicknesses by Microscopical Examination of a Cross Section

ASTM D 1193 Reagent Water

ASTM D 1894 Static and Kinetic Coefficients of Friction of Plastic Film and Sheeting

ASTM D 4060 Abrasion Resistance of Organic Coatings by the Taber Abraser

3. TECHNICAL REQUIREMENTS

3.1 Preparation

3.1.1 The coating shall be applied to a surface free from water breaks. The cleaning procedure shall not produce pitting or intergranular attack of the basis metal and shall preserve dimensional requirements.

3.1.2 Tight electrical contact shall be maintained during the anodic treatment to prevent contact arcing (burning) of parts, but small irregularities of coating at points of electrical contact are acceptable. When not otherwise specified by the purchaser, the location of electrical contact points shall be as follows. For parts which are to be coated all over, locations shall be acceptable to purchaser. For parts which are not to be coated all over, locations shall be in areas on which coating is not required.

3.1.3 A suitable maskant shall be applied to any area or areas where anodize is not permitted, solution entrapment may occur such as faying surfaces, or where there is another metal such as a thread insert.

3.2 Procedure

An anodic potential shall be impressed on the parts while immersed in a suitable electrolyte to induce formation of aluminum oxide, codeposited or impregnated with PTFE. After coating, parts shall be thoroughly rinsed in cold, clean water and dried.

3.3 Properties

Coating on parts shall conform to the following requirements:

3.3.1 Thickness

AMS2482 designates finished coating thickness of 0.002 inch ± 0.0005 (51 µm ± 13). Other coating thicknesses may be specified by this specification number and a suffix number designating the nominal thickness in thousandths of an inch (25 µm). A tolerance of ±0.0005 inch (±13 µm) in thickness of coating will be allowed. Thus, AMS2482-3 designates a finished coating thickness of 0.003 inch ± 0.0005 (76 µm ± 13).

3.3.1.1 Thickness of coating shall be as specified on the drawing determined in accordance with any of the following methods as applicable: microscopic method, micrometer measurement, eddy-current method in accordance with ASTM B 244 or ASTM B 487, or other method acceptable to the cognizant engineering organization. See 4.3.3.2.

3.3.1.2 Coating thickness requirements shall not apply to blind holes or recesses with depth greater than twice the diameter or in open holes with depth greater than seven times the diameter unless a specific coating thickness is specified in those areas.

3.3.2 Corrosion Resistance

The coated specimens (4.3.3.3) shall meet the following requirements determined after exposure for not less than 336 hours to salt spray test in accordance with ASTM B 117, except that the significant surface shall be inclined approximately 6 degrees from vertical. The five test panels shall show not more than a total of 15 isolated pits, none larger than 1/32 inch (0.8 mm) in diameter, in a total of 150 sq inches (968 cm^2) of test area Individual test specimens, after salt-spray testing, shall show no more than five isolated pits, none larger then 1/32 inch (0.8 mm) in diameter, in a total of 30 square inches (194 cm^2) of test area. See 8.2.1. Areas within 1/16 inch (1.6 mm) of identification markings and electrical contact marks shall not be included.

3.3.3 Abrasion Resistance

The coated specimens (4.3.3.4) shall have a maximum wear index of 4.0 mg/1000 cycles on aluminum alloys having a nominal copper content of two percent or higher and a maximum wear index of 2.0 mg/1000 cycles for all other alloys, determined as follows: two test specimens weighed to the nearest milligram shall be tested in accordance with ASTM D 4060, using CS-17 wheels with a 1000-gram load for 10 000 cycles. After abrading, the specimens shall be weighed to the nearest milligram to determine weight loss. The wear index is determined at the end of 10 000 cycles by dividing the weight loss by ten. Specimens may be placed in a desiccator prior to and following testing to establish constant weight in lieu of conditioning specified in ASTM D 4060. The abrasive wheels shall be resurfaced prior to the start of any individual test, and at least once every 10 000 cycles.

3.3.4 Coefficient of Friction

The coated specimens (4.3.3.5) tested in accordance with ASTM D 1894 or other method acceptable to the cognizant engineering organization shall have a maximum coefficient of friction of 0.15.

3.4 Quality

Coating, as received by purchaser, shall be smooth, uniform in appearance, and free from scratches, chips, and burned areas. Small irregularities at points of electrical contact are permitted.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The coating processor shall supply all samples for processor's tests shall be responsible for performance of all required tests. When parts are to be tested, such parts shall be supplied by purchaser. The cognizant engineering organization reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the coating conforms to the specified requirements.

4.2 Classification of Tests

4.2.1 Acceptance Tests

Thickness (3.3.1) and quality (3.4) are acceptance tests and shall be performed on parts, or specimens representing parts when permitted herein, from each lot. See 4.3.3.

4.2.2 Periodic Tests

Corrosion resistance (3.3.2) and abrasion resistance (3.3.3) are periodic tests and shall be performed at least monthly unless frequency of testing is specified by the cognizant engineering organization. Coefficient of friction (3.3.4) is a periodic test and shall be performed at least semi-annually unless frequency of testing is specified by the cognizant engineering organization. Tests of cleaning and processing solutions are periodic tests and shall be performed at a frequency established by the processor unless frequency of testing is specified by the cognizant engineering organization. See 8.5 and 4.4.3.

4.2.3 Preproduction Tests

All property verification tests (section 3.4) are preproduction tests and shall be performed prior to or on the initial shipment of coated parts to a purchaser and when the cognizant engineering organization requires confirmatory testing.

4.3 Sampling for Testing

4.3.1 Acceptance Tests

Acceptance test samples shall be randomly selected from all parts in the lot. A lot shall be all parts of the same part number, processed in a continuous series of operations in not longer than 24 consecutive hours, and presented for processor's inspection at one time. Unless the cognizant engineering organization provides a sampling plan, the minimum number of samples shall be as shown in Table 1.

TABLE 1 - MINIMUM SAMPLING FOR ACCEPTANCE TESTS

Number of Parts in Lot	Quality	Thickness
Up to 7	All	3 or all*
8 to 15	7	4
16 to 40	10	4
41 to 110	15	5
111 to 300	25	6
301 to 500	35	7
Over 500	50	8

*Whichever is less

4.3.2 Periodic Tests

Sample quantities shall be five for corrosion resistance (3.3.2) and two each for abrasion resistance (3.3.3) and coefficient of friction (3.3.4) unless otherwise specified by the cognizant engineering organization.

4.3.2.1 If test panels of an alloy different from that of the parts they represent are used, panels shall be processed under conditions, previously established, which will produce the same coating thickness as that on the parts they represent.

4.3.3 Sample Configuration

4.3.3.1 Separate test specimens may be used under any one of the following circumstances: The parts are of such configuration or size as to be not readily adaptable to specified tests, nondestructive testing is not practical on actual parts, or it is not economically acceptable to perform destructive tests on actual parts. Except as specified below, acceptance test specimens shall be made of the same alloy as the parts represented and periodic test specimens shall be fabricated from the predominant alloy anodized since the last periodic test. Acceptance test specimens shall be distributed within the lot, cleaned, and processed with the parts. Whenever possible, specimens shall be processed with an actual production lot.

4.3.3.2 Thickness

When micrometer measurement (3.3.1.1) is used, specimens for thickness determination shall be of the same alloy as the parts they represent and shall be processed with the parts represented. The specimens shall be 0.04 x 2 x 4 inches (1.0 x 51 x 102 mm) or of suitable configuration to provide an accurate measurement. Micrometer measurements shall be validated against microscopic measurements on specimens processed to the same nominal coating thickness.

4.3.3.3 Corrosion resistance (3.3.2) test panels shall be 0.025 to 0.063 inch (0.64 to 1.60 mm) thick and not less than 3 x 10 inches (76 x 254 mm) in width and length fabricated from AMS4037 (2024-T3).

4.3.3.4 Abrasion resistance test (3.3.3) specimens shall be either 4-inch (102-mm) diameter round or 4 inches (102 mm) square panel fabricated from AMS4037 (2024-T3), aluminum alloy sheet, or the predominant alloy (as defined above) anodized measuring not less than 0.063 inch (1.60 mm) thick with a 0.250-inch (6.35-mm) diameter hole in the center and shall not have been given a supplementary sealing treatment.

4.3.3.5 Coefficient of friction (3.3.4) test specimens shall be either 0.04 x 5 x 10 inches (1.0 x 127 x 254 mm) or other suitable configuration to ensure accurate measurement fabricated from AMS4037 (2024-T3) aluminum alloy sheet or the predominant alloy being processed. Testing shall be in accordance with ASTM D 1894 or other method acceptable to the cognizant engineering organization. Maximum coefficient of friction shall be 0.15.

4.4 Approval

4.4.1 Sample coated parts and/or the coating and control procedure used to coat parts shall be approved by the cognizant engineering organization before coated parts for use are supplied. When sample coated parts are required, coatings on production parts shall be equivalent to those on the approved sample parts.

4.4.2 If the processor shall makes a significant change to any material, process, or control factor from those on which approval was based, unless the change is approved by the cognizant engineering organization. A significant change is one which, in the judgment of the cognizant engineering organization, would affect the properties or performance of the part.

4.4.3 Control factors shall include, but not be limited to, the following:

Surface preparation methods
Composition limits and temperature limits of anodizing bath
For Type 1: method of application of PTFE
Method for determining coating thickness, and, if micrometer measurements are used, correlation between measurement and actual thickness
Anodizing voltage limits, and voltage ramp rates where voltage is not constant
Periodic test plan for cleaning and processing solutions. See 8.5.

4.5 Reports

The processor of coated parts shall furnish with each shipment a report stating that the parts have been processed and tested in accordance with specified requirements of this specification and that the parts conform to the acceptance test requirements. This report shall include the purchase order number, anodize thickness, lot number, AMS2482D, part number, and quantity.

4.6 Resampling and Retesting

4.6.1 If any acceptance test fails to meet specified requirements, the parts may be stripped, pretreated, coated, and retested. Alternatively, all parts in the lot may be inspected for the nonconforming attribute, and the nonconforming parts may be stripped, pretreated, coated, and retested.

4.6.1.1 When stripping is to be performed for a given lot, approval shall be granted by the cognizant engineering organization. The method that shall not roughen, pit, or embrittle the basis metal or adversely affect part dimensions.

4.6.2 If any periodic test fails to meet the specified requirements, the process is nonconforming. No additional part shall be coated until the process is corrected and new specimens are coated and retested. Results of all tests shall be recorded and, when requested, reported. Purchaser shall be notified of all parts since the last acceptable test.

5. PREPARATION FOR DELIVERY

5.1 Coated parts shall be handled and packaged to ensure that the required physical characteristics and properties of the coating are preserved.