



<b>AEROSPACE MATERIAL SPECIFICATION</b>	<b>AMS2491™</b>	<b>REV. G</b>
	Issued 1961-01 Reaffirmed 2003-05 Stabilized 2015-01 Revised 2022-07  Superseding AMS2491F	
Surface Treatment of Polytetrafluoroethylene (PTFE) Preparation for Bonding		

### RATIONALE

This specification is being brought out of the “stabilized” classification and revised to include additional test methods to differentiate between rigid and flexible substrates and to add pertinent shelf life information.

#### 1. SCOPE

##### 1.1 Purpose

This specification covers the engineering requirements for preparing surfaces of both virgin and filled polytetrafluoroethylene (PTFE) materials for bonding and the properties resulting from the treatment.

##### 1.2 Application

This process has been used typically for rendering surfaces of PTFE product, sheets, tapes, etc., capable of supporting a high strength adhesive bond. The strength of such bonds is dependent upon the substrate, the adhesive, and the bonding process being utilized. This bonding preparation can affect the electrical properties of the PTFE and this should be considered before using it for treatment of electronic components.

##### 1.3 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.

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## 2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), [www.sae.org](http://www.sae.org).

AMS3690 Adhesive Compound, Epoxy, Room Temperature Curing

## 2.2 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](http://www.astm.org).

ASTM D413 Standard Test Methods for Rubber Property - Adhesion to Flexible Substrates

ASTM D897 Tensile Properties of Adhesive Bonds

ASTM D1002 Apparent Shear Strength of Single Lap Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal to Metal)

## 3. TECHNICAL REQUIREMENTS

### 3.1 Material

The surface treating agent shall be a solution of sodium or other alkali metal in anhydrous liquid ammonia or tetrahydrofuran-naphthalene or other suitable solvent.

#### 3.1.1 Safety Precaution

Sodium metal reacts violently with water. Tetrahydrofuran solvent is highly flammable. Therefore, it is essential that personnel performing the etching process and handling these materials be trained and experienced in their use. Preparation of the surface activation solution must be carried out in a properly vented area. It is the user/processor's responsibility to determine and enforce proper training requirements and process precautions that assure maximum safety.

### 3.2 Preparation

Product to be treated shall be cleaned free from dirt, grease, oil, and other contamination. Cleaned product shall be thoroughly dried prior to surface treatment.

### 3.3 Procedure

The clean, dry product shall be exposed to the surface treating agent until all surfaces to be bonded meet the color requirements of 3.5.1.

### 3.4 Post-Treatment

The treated product shall be cleaned and thoroughly dried. A suitable cleaning technique involves immersion of the product in acetone, a water rinse, followed by a final rinse with clean, anhydrous acetone.

3.4.1 Treated product which is not to be bonded immediately shall be packaged in heat-sealed black polyethylene bags in a manner which will prevent exposure to ultraviolet light and surface contamination.

### 3.5 Properties

Treated product shall conform to the following requirements:

#### 3.5.1 Color

For virgin and filled PTFE materials that are originally light in appearance, the etched color should be tan-to-dark brown/black. For filled PTFE materials that are originally dark in appearance, the etched color should be mid to dark brown/black. The etched surface(s) shall exhibit complete coverage. Variations in color, even on the same sample, typically referred to as mottling, shall be permitted provided all areas meet the color requirements of this specification. The sample-to-sample color variations observed may be considerable even after undergoing the same treatment process.

#### 3.5.2 Tensile and Shear Strengths - Rigid Substrates

Representative specimens of PTFE, surface-treated on both sides using the same process as the product represented and bonded to the applicable aluminum specimens with an epoxy adhesive compound conforming to AMS3690, shall meet the requirements of 3.5.2.1 and 3.5.2.2. Where tape material is supplied, the tensile sample may be the thickness of material as skived and surface treated.

##### 3.5.2.1 Tensile Strength

Shall be not less than 1000 psi (6.90 MPa) at 70 to 75 °F (21 to 24 °C), determined in accordance with ASTM D897 on specimens prepared by bonding a treated polytetrafluoroethylene disc, approximately 0.030 inch (0.76 mm) thick, between the two halves of a standard aluminum alloy tensile specimen.

##### 3.5.2.2 Shear Strength

Shall be not less than 1000 psi (6.90 MPa) at 70 to 75 °F (21 to 24 °C), determined in accordance with ASTM D1002 on specimens prepared by bonding a treated polytetrafluoroethylene strip, not greater than 0.030 inch (0.76 mm) in thickness, between standard aluminum alloy lap shear plates.

#### 3.5.3 90 Degree Peel Strength - Flexible Substrates (Elastomers, Flexible Plastics, etc.)

Representative specimens of PTFE, surface-treated on one side using the same process as the product represented and bonded to the applicable flexible substrate shall have an adhesion value of no less than 12 p.p.i.w. when tested in accordance with 3.5.3.1.

##### 3.5.3.1 Prepare Type A Test Specimens in Accordance with ASTM D413 Paragraph 6.1.

1. A treated polytetrafluoroethylene strip, 1.000 inch  $\pm$  0.02 inch wide, shall be bonded to the exposed surface of the flexible substrate using the same bonding process as used on production product. Leave a sufficient area at the ends of the strip unbonded to allow for the grips of the testing device.
2. Test in accordance with the procedure described in ASTM D413, paragraph 10.2.
3. For thin PTFE film (up to 0.005 inch thickness), if the film breaks prior to peeling, this is considered a satisfactory result; report as the "value at break."

### 3.6 Quality

Surfaces of treated product, as received by purchaser, shall exhibit complete coverage, shall meet the color requirements of this specification, and shall be free from imperfections detrimental to usage of the treated product.

## 4. QUALITY ASSURANCE PROVISIONS

### 4.1 Responsibility for Inspection

The processor shall supply all specimens for processor's tests and shall be responsible to assure that all required testing has been performed and that the data is available. Purchaser reserves the right to sample and to perform any confirmatory testing that they feel may be necessary to ensure that the processing conforms to the specified requirements.

### 4.2 Classification of Tests

#### 4.2.1 Acceptance Tests

4.2.1.1 If the application substrate for the etched PTFE is not specified, then the acceptance tests shall consist of color uniformity (3.5.1), shear strength (3.5.2.2), and quality (3.6), and shall be performed on each lot.

4.2.1.2 If the application substrate for the etched PTFE is specified in the purchase document as a flexible substrate, then the acceptance tests shall consist of color uniformity (3.5.1), peel strength (3.5.3), and quality (3.6).

#### 4.2.2 Periodic Tests

Tensile strength (3.5.2.1) is a periodic test and shall be performed at a frequency selected by the processor, unless frequency of testing is specified by purchaser.

#### 4.2.3 Preproduction Tests

All technical requirements are preproduction tests and shall be performed prior to or on the initial shipment of treated product by the processor, when a change in material and/or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

### 4.3 Sampling

Sampling shall be as follows: a lot shall be all product treated in a single production run under the same fixed conditions and presented for processor's inspection at one time.

#### 4.3.1 For Acceptance Tests

The number of products sampled shall not be less than shown in Table 1.

**Table 1 - Sampling for acceptance testing**

Number of Parts in Lot	Color and Quality	Shear Strength
Up to 7	All	3
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

#### 4.3.1.1 Skived Tape

Two samples for shear strength testing in accordance with 3.5.2.2 shall be prepared from every 50 feet (15.2 m), or if more than 6 inches wide, every 50 ft<sup>2</sup> (4.6 m<sup>2</sup>) from the treated tape material of the thickness ordered. Where samples cut from a continuous run may adversely affect a production run, purchaser may waive this requirement and instead specify samples to be taken from the beginning and end of a continuous, uncut run of tape material. Where tape material is required to have only one side surface treated, a suitable length of material shall be cut from each end to allow samples to be prepared and both sides surface treated at the same time as the production run of material.