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AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Specification for Fluorocarbon Perfluoromethoxy (MFA) Resin Molding and Extrusion Materials¹

This standard is issued under the fixed designation D 6314; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers melt processible molding and extrusion materials that are copolymers of tetrafluoroethylene (TFE) containing perfluoroalkoxy side chains. These side chains are predominately perfluoromethoxy (MFA) chains derived from perfluoro(methyl vinyl ether) and may contain perfluoroalkoxy groups from other perfluoro(vinyl ethers).

1.2 This specification does not cover recycled plastics.

1.3 The tests involved are intended to provide information for identifying the materials covered. It is not the function of this specification to provide engineering data for design purposes. Specimens prepared by injection molding or extrusion could yield test results that may vary from the values in this specification.

1.4 The values stated in SI units, as detailed in IEEE/ASTM SI 10, are to be regarded as the standard. The values given in parentheses are for information only.

1.5 The following safety hazards caveat pertains only to the test methods portion, Section 9, of this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

NOTE 1—The materials of this specification can be designated and specified according to the system of ISO 12086-1 and the test methods of ISO 12086-2. Details are provided in Appendix X1.

2. Referenced Documents

2.1 ASTM Standards:

- D 150 Test Methods for A-C Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulating Materials²
- D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing³
- D 638M Test Method for Tensile Properties of Plastics Metric³
- D 792 Test Methods for Specific Gravity (Relative Density)

of Plastics by Displacement³

D 883 Terminology Relating to Plastics³

D 1238 Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer³

D 1505 Test Method for Density of Plastics by the Density-Gradient Technique³

D 1600 Terminology for Abbreviated Terms Relating to Plastics³

D 2116 Specification for FEP-Fluorocarbon Molding and Extrusion Materials³

D 3307 Specification for PFA-Fluorocarbon Molding and Extrusion Materials⁴

D 3892 Practice for Packaging/Packing of Plastics⁴

D 4591 Test Methods for Determining Temperatures and Heats of Transitions of Fluoropolymers by Differential Scanning Calorimetry⁵

D 4895 Specification for Polytetrafluoroethylene (PTFE) Resins Produced from Dispersion⁵

E 177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods⁶

2.2 IEEE/ASTM Standard:

IEEE/ASTM SI 10 Standard for the Use of the International System of Units (SI): The Modern Metric System⁶

2.3 ISO Standards:

ISO 12086-1: 1995 Plastics—Fluoropolymer Dispersions and Moulding and Extrusion Materials, Part 1-Designation System and Basis for Specifications⁷

ISO 12086-2: 1995 Plastics—Fluoropolymer Dispersions and Moulding and Extrusion Materials, Part 2-Preparation of Test Specimens and Determination of Properties⁷

3. Terminology

3.1 *Definitions*—Definitions of terms used in this specification shall be in accordance with Terminology D 883.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *lot, n*—one production run or a uniform blend of two or more production runs.

3.2.2 *MFA*—a copolymer of tetrafluoroethylene and one or more perfluoro(alkyl vinyl ethers) in which perfluoro(methyl

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² Annual Book of ASTM Standards, Vol 10.01.

³ Annual Book of ASTM Standards, Vol 08.01.

⁴ Annual Book of ASTM Standards, Vol 08.02.

⁵ Annual Book of ASTM Standards, Vol 08.03.

⁶ Annual Book of ASTM Standards, Vol 14.02.

⁷ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

vinyl ether) is the predominant perfluoro(alkyl vinyl ether).

3.2.2.1 *Discussion*—The term perfluoro(alkyl vinyl ether) defined as PFA in Terminology D 1600 includes perfluoro(methyl vinyl). To prevent confusion with the higher melting PFA materials covered in Specification D 3307, the abbreviated term, MFA, and the definition above are provided.

4. Classification

4.1 This specification covers two types of MFA-fluorocarbon resins supplied in pellet form for molding and extrusion.

4.2 A one line system may be used to specify material covered by this specification. The system uses predefined cells to refer to specific aspects of this specification, illustrated as follows:

Specification	
Standard Number Block	Type
Example Specification: D XXXX-XXX	1

NOTE 2—A comma is used as the separator between the standard number and the type. Provision for special notes is included so that other information can be provided when required. An example would be in Specification D 3295 where dimensions and tolerances are specified for each AWG size within type and class.

When special notes are used, they should be preceded by a comma.

5. General Requirements

5.1 The materials shall be of uniform composition and so prepared as to confirm to the requirements of this specification.

5.2 The materials described in this specification shall be free of foreign matter to such a contamination level as may be agreed upon between and purchaser and the seller.

6. Detailed Requirements

6.1 The materials covered by this specification shall conform to the requirements prescribed in Tables 1 and 2 when tested by the procedures specified herein. Table 2 lists those tests requiring a specimen molded as described in 9.1.

7. Sampling

7.1 Sampling shall be statistically adequate to satisfy the requirements of 6.1.

8. Number of Tests

8.1 One set of test specimens as prescribed in Section 9 shall be considered sufficient for testing each sample.

8.2 The average result of the specimens tested shall conform to the requirements of this specification.

9. Test Methods

9.1 Test Specimens:

9.1.1 Prepare a molded sheet 1.5 ± 0.25 -mm (0.060 ± 0.010 -in.) thick. Use a picture-frame type chase having a suitable blanked-out section and thickness to produce the

TABLE 2 Detail Requirements for Molded Test

	Specimens	
	Type I	Type II
Specific gravity, 23/23°C (73.4/73.4°F):		
min	2.12	2.12
max	2.17	2.17
Tensile strength, min, 23°C (73.4°F):		
Mpa	20.68	26.20
psi	3000	3800
Elongation, 23°C (73.4°F):		
min, %	275	300
Dielectric constant, max:		
10 ² Hz	2.2	2.2
10 ⁶ Hz	2.2	2.2
Dissipation factor, max:		
10 ² Hz	0.0003	0.0003
10 ⁶ Hz	0.0003	0.0005

desired sheet. Use clean aluminum foil, 0.13 to 0.18-mm (0.005 to 0.007-in.) thick in contact with the resin. A high-temperature mold release agent may be sprayed on the aluminum foil to help prevent the foil from sticking to the sheet. Use steel molding plates at least 1.0-mm (0.040-in.) thick and of an area adequate to cover chase.

9.1.2 Lay down and smoothly cover one plate with a sheet of aluminum foil. Place the mold chase on top of this assembly. Place within the mold chase sufficient molding material to produce the required sheet in such manner that the polymer charge is a mound in the middle of the chase. Place a second sheet of aluminum foil on top of the granules and add the top mold plate. Place the assembly in a compression molding press having platens that have been heated to 380° C ($716 \pm 10^\circ$ F).

9.1.3 Bring the press platens to incipient contact with the mold assembly. Hold for 2 to 4 min without pressure. Apply approximately 1 MPa (145 psi) and hold for 1 to 1.5 min; then, apply 2 to 4 MPa (290 to 580 psi) and hold for 1 to 1.5 min. Maintain the press at $380 \pm 5^\circ$ C ($716 \pm 10^\circ$ F) during these steps. Remove the assembly from the press and place between two 20 ± 7 -mm (0.75 ± 0.25 -in.) steel plates whose temperature is less than 40 °C (104 °F).

9.1.4 When the sheet is cool enough to touch (about 50 to 60°C (122 to 140°F), remove aluminum foil from the sheet.

NOTE 3—If the sheet is allowed to cool to room temperature, the aluminum foil cannot be pulled free.

9.2 Conditioning:

9.2.1 For tests of specific gravity, tensile properties and electrical properties, condition the molded test specimens in accordance with Procedure A of Practice D 618 for a period of at least 4h prior to test. The other tests require no conditioning.

9.2.2 Conduct tests at the standard laboratory temperature $23 \pm 2^\circ$ C ($73.4 \pm 3.6^\circ$ F) for determination of specific gravity, tensile properties, and electrical properties only. Since the resin does not absorb water, the maintenance of constant humidity during testing is not necessary. Conduct tests for flow rate and melting endotherm under ordinary laboratory conditions.

9.3 *Melt Mass Flow Rate (MFR)*—Determine the MFR in accordance with Test Method D 1238, Method A or B, Temperature 372 °C and using a total load of 5000 g. The same requirements noted in Specification D 3307 apply for the use of corrosion-resistant alloy for the barrel lining, die, and piston tip.

TABLE 1 Detail Requirements for Tests on Molding and Extrusion Materials

	Type I	Type II
Melt mass flow rate (MFR), g/10 min		
min	10	2
max	17	5
Melting endotherm peak temperature, min, C:	280	280