



Designation: ~~D2116-02~~ Designation: D 2116 - 07

## Standard Specification for FEP-Fluorocarbon Molding and Extrusion Materials<sup>1</sup>

This standard is issued under the fixed designation D 2116; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the Department of Defense.*

### 1. Scope\*

1.1 This specification covers melt processable molding and extrusion materials of FEP-fluorocarbon resin. This specification does not cover recycled FEP materials. These FEP resins are copolymers of tetrafluoroethylene and hexafluoropropylene or modified FEP-fluorocarbon resins containing not more than 2 % by weight of other fluoromonomers.

1.2 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.

NOTE 1—Although this specification and ISO 12086-1 and ISO 12086-2 differ in approach or detail, data obtained using either are technically equivalent.

1.3 The following precautionary caveat pertains only to the test methods portion, Section 11, 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.*

### 2. Referenced Documents

#### 2.1 ASTM Standards:<sup>2</sup>

D 150 Test Methods for ~~A-CAC~~ Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical ~~Insulating Materials-Insulation~~

D 618 Practice for Conditioning Plastics for Testing

D 638 Test Method for Tensile Properties of Plastics

D 792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement

D 883 Terminology Relating to Plastics

D 1238 Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer

D 1600 Terminology for Abbreviated Terms Relating to Plastics

~~D3295 Specification for PTFE Tubing~~ 3295 Specification for PTFE Tubing, Miniature Beading and Spiral Cut Tubing

D 3418 Test Method for Transition Temperatures of Polymers by Thermal Analysis<sup>4</sup> Test Method for Transition Temperatures and Enthalpies of Fusion and Crystallization of Polymers by Differential Scanning Calorimetry

D 3892 Practice for Packaging/Packing of Plastics

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

IEEE/ASTM SI-10 Use of the International System of Units (SI): The Modern Metric System<sup>3</sup>

#### 2.2 ISO Standards:<sup>4</sup>

~~ISO 12086-1:1995~~ ISO 12086-1 Plastics—Fluoropolymer Dispersions and Moulding and Extrusion Materials—Part 1

~~ISO 12086-2:1995~~ ISO 12086-2 Plastics—Fluoropolymer Dispersions and Moulding and Extrusion Materials—Part 2

### 3. Terminology

#### 3.1 Definitions:

3.1.1 *General*—The definitions given in Terminology D 883 are applicable to this specification.

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.15 on Thermoplastic Materials (Section D20.15.12).

Current edition approved December 10, 2002; Nov. 1, 2007. Published February 2003; November 2007. Originally approved in 1962. Last previous edition approved in 1997; 2002 as D2116-97; D 2116 - 02.

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards*, Vol 10.01, volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 08.01.

<sup>3</sup> Available from ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 08.02.

<sup>4</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

\*A Summary of Changes section appears at the end of this standard.

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

3.2 *Abbreviated Terms:*

3.2.1 *General*—The abbreviated terms given in Terminology D 1600 are applicable to this specification.

#### **4. Classification**

4.1 This specification covers four types of FEP-fluorocarbon resin supplied in pellet form classified according to their melt flow rate.

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

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Specification				
Standard Number	:	Type	:	Special notes
Block	:		:	
_____	:	_____	:	_____
Example: Specification D 2116 – XX,	:	I	:	

For this example, the line callout would be Specification D 2116 – XX, I and would specify an FEP-fluorocarbon resin that has all of the properties listed for that type, grade, and class in the appropriate specified properties or tables, or both, in the specification identified. A comma is used as the separator between the standard number and the type.<sup>5</sup> A provision for special notes is included so that other information can be provided when required. When special notes are used, precede them with a comma.

## 5. General Requirements

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

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

## 6. Detail Requirements

6.1 The average test result of the lot shall conform to the requirements prescribed in Table 1 and Table 2 when tested by the

**TABLE 1 Detail Requirements for Test on Molding Materials**

	Type I	Type II	Type III	Type IV
Melt flow rate, g/10 min:				
Load, 5000 g:				
Min	4.0	>12.0	0.8	2.0
Max	12.0	...	2.0	3.9

**TABLE 2 Detail Requirements for Molded Test Specimens**

	Type I	Type II	Type III	Type IV
Specific gravity 23/23°C (73/73°F)				
Min	2.12	2.12	2.12	2.12
Max	2.17	2.17	2.17	2.17
Melting point, °C	260 ± 20	260 ± 20	260 ± 20	260 ± 20
Tensile strength, 23°C (73°F), min:				
MPa	17.3	14.5	20.7	18.7
psi	2500	2100	3000	2700
Elongation, 23°C (73°F), min, %	275	240	275	275
Dielectric constant, max:				
At 10 <sup>3</sup> Hz	2.15	2.15	2.15	2.15
At 10 <sup>6</sup> Hz	2.15	2.15	2.15	2.15
Dissipation factor, max:				
At 10 <sup>3</sup> Hz	0.0003	0.0003	0.0003	0.0003
At 10 <sup>6</sup> Hz	0.0007	0.0009	0.0007	0.0007

procedures specified herein. Table 2 lists those tests requiring a specimen molded as described in Section 8.

## 7. Sampling

7.1 Sampling shall be statistically adequate to satisfy requirements of 13.1.1.

## 8. Test Specimens

8.1 Prepare a molded sheet  $1.5 \pm 0.3$  mm ( $0.060 \pm 0.010$  in.) thick. Use a picture-frame-type chase having a suitable blanked-out section and thickness to produce the 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 shall 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 the chase.

8.2 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 a manner that the polymer charge is a

<sup>4</sup> Annual Book of ASTM Standards, Vol 14.02.

<sup>5</sup> See the ASTM *Form and Style Manual*, available from ASTM Headquarters.