



Designation: **D6040—06 D6040 – 12**

# Standard Guide to Standard Test Methods for Unsintered Polytetrafluoroethylene (PTFE) Extruded Film or Tape<sup>1</sup>

This standard is issued under the fixed designation D6040; 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.

## 1. Scope\*

1.1 This guide identifies test methods to use in evaluating unsintered extruded films or tapes manufactured from polytetrafluoroethylene.

1.2 The values stated in SI units as detailed in **IEEE/ASTM SI 10**, are to be regarded as standard.

1.3 *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—This test method is equivalent to ISO 12086-2:2006 in the measurement of tensile properties, specific gravity, and dielectric constant. These are in ISO 12086-2:2006, sections 8.2.2, 10.6 and 8.1.1. It is not equivalent to ISO 12086-2:2006 in any other measurement or section..

## 2. Referenced Documents

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

**D149** Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies

**D150** Test Methods for AC Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulation

**D257** Test Methods for DC Resistance or Conductance of Insulating Materials

**D374** Test Methods for Thickness of Solid Electrical Insulation

**D792** Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement

**D882** Test Method for Tensile Properties of Thin Plastic Sheeting

**D883** Terminology Relating to Plastics

**D1711** Terminology Relating to Electrical Insulation

~~**D2288** Test Method for Weight Loss of Plasticizers on Heating (Withdrawn 2010)~~<sup>3</sup>

**D3776** Test Methods for Mass Per Unit Area (Weight) of Fabric

**F335** Terminology Relating to Electrostatic Imaging

**F412** Terminology Relating to Plastic Piping Systems

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

2.2 *ISO Standard:*

**ISO 12086-2:2006** Plastics—Fluoropolymer Dispersions and Moulding and Extrusion Materials—Part 2: Preparation of Test Specimens and Determination of Properties<sup>3</sup>

## 3. Terminology

3.1 *Definitions:*

3.1.1 Definitions are in accordance with Test Methods **D257** and Terminologies **D883** and **D1711**, unless otherwise specified.

3.1.2 *apparent density,  $n$* —the weight per unit volume of a material including voids inherent in the material as tested, see Terminology **F412**.

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

<sup>1</sup> This guide is under the jurisdiction of ASTM Committee **D20** on Plastics and is the direct responsibility of Subcommittee **D20.15** on Thermoplastic Materials. Current edition approved April 1, 2006/Aug. 1, 2012. Published April 2006/September 2012. Originally approved in 1996. Last previous edition approved in 2004/2006 as **D6040-01-D6040-06**. DOI: 10.1520/D6040-06.10.1520/D6040-12.

<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* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036-10036, <http://www.ansi.org>.

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

### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *film, n*—full-width material received as finished film.

3.2.2 *tape, n*—material that has been slit from the finished film.

3.2.3 *volume resistivity, n*—the volume resistance (in ohm-centimetres) between opposite faces of a material where the values are obtained by the measure of resistance to electrical current between electrodes placed in contact with the opposing surfaces of the sample (see Terminology F335).

## 4. Test Specimens

4.1 The number of test specimens shall be in accordance with the requirements of the individual test methods.

## 5. Conditioning

5.1 Condition the tape for 4 h and conduct tests at the standard laboratory temperature of  $23 \pm 2^\circ\text{C}$  [ $73.4 \pm 3.6^\circ\text{F}$ ], unless otherwise specified in the test methods or required in a specification. Since the tape or film does not absorb water, the maintenance of constant humidity during testing is not important.

## 6. Width

6.1 Determine width measurements using a steel scale having divisions at a minimum of 0.5-mm [ $1/64$ -in.] intervals.

6.2 Test at least one specimen from each lot.

6.3 Each test specimen shall be approximately 450 mm [18 in.] in length. Place the specimens on a hard smooth surface. Measure the width perpendicular to the edge of the steel scale, at three approximately equally spaced points along the length.

6.4 Report the average width in millimetres [or inches] plus the maximum and minimum values if they are required by a specification.

## 7. Thickness

7.1 Measure thickness of the tape and film in accordance with Test Methods D374. Test Method D shall be the preferred method. The force on the foot shall not exceed 300 g. Test Method B shall not be used as the film is compressible, and there is no restraint on how much compression is used.

NOTE 2—Alternate methods and equipment are permitted based on documented agreement between producer and buyer.

### 7.2 Report:

7.2.1 Report the average thickness to the nearest 0.0025 mm [0.0001 in.] plus the maximum and minimum, if specified.

7.2.2 Report the test method from Test Methods D374 if other than Test Method D is used.

## 8. Tensile Properties

8.1 Determine tensile strength and elongation in accordance with Test Methods D882. Calculate tensile strength and percentage elongation from the values at the maximum load.

NOTE 3—Unsintered PTFE does not exhibit a clean break as is normal for most thin plastic sheeting.

NOTE 4—In some industries elongation at material rupture is important to process control. In such cases it is permissible to include this information as well when agreed to between producer and buyer.

8.2 Randomly select five specimens per lot and test.

### 8.3 Report:

8.3.1 Report the average tensile strength and the minimum and maximum values in megapascals (MPa) (pound-force per square inch (psi)).

8.3.2 Report the average percentage elongation at maximum load and the minimum and maximum values.

## 9. Specific Gravity (Relative Density)

9.1 Determine specific gravity in accordance with Test Method A of Test Methods D792. Other equipment shown to give comparable results may be used.

NOTE 5—Test Methods D792 can be used due to the inability of water to penetrate the film or tape, generally be used as PTFE film or tape typically exhibits hydrophobic characteristics.

NOTE 6—Especially useful for this test, has been the electronic densimeter, Model ED-120 T.<sup>4</sup>

<sup>4</sup> The sole source of supply of the apparatus known to the committee at this time is Testing Machines, Inc., 400 Bayview Avenue, Amityville, NY 11701. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,<sup>1</sup> which you may attend.