



Designation: D5675 – 04(Reapproved 2010)

Standard Classification for Fluoropolymer Micropowders¹

This standard is issued under the fixed designation D5675; 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 classification system provides a method of adequately identifying PTFE micropowders using a system consistent with that of Classification System **D4000**. It further provides a means for specifying these materials by the use of a simple line callout designation. This classification covers fluoropolymer micropowders that are used as lubricants and as additives to other materials in order to improve lubricity or to control other characteristics of the base material.

1.2 These powders are sometimes known as lubricant powders. The powders usually have a much smaller particle size than those used for molding or extrusion, and they generally are not processed alone. The test methods and properties included are those required to identify and specify the various types of fluoropolymer micropowders. Recycled fluoropolymer materials meeting the detailed requirements of this classification are included (see Guide **D5033**).

1.3 These micropowders and the materials designated as filler powders (F) in ISO 12086-1 and ISO 12086-2 are equivalent.²

1.4 The values stated in SI units as detailed in **IEEE/ASTM SI-10** are to be regarded as the standard.

1.5 *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.* Specific precautionary statements are given in **7.1.2**.

2. Referenced Documents

2.1 ASTM Standards:³

¹ This classification is under the jurisdiction of ASTM Committee **D20** on Plastics and is the direct responsibility of Subcommittee **D20.15** on Thermoplastic Materials.

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² Designations, specifications, and test methods are included in ISO 12086-1 and 12086-2.

³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

D854 Test Methods for Specific Gravity of Soil Solids by Water Pycnometer

D883 Terminology Relating to Plastics

D1238 Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer

D1600 Terminology for Abbreviated Terms Relating to Plastics

D3892 Practice for Packaging/Packing of Plastics

D4000 Classification System for Specifying Plastic Materials

D4464 Test Method for Particle Size Distribution of Catalytic Material by Laser Light Scattering

D4567 Test Method for Single-Point Determination of Specific Surface Area of Catalysts and Catalyst Carriers Using Nitrogen Adsorption by Continuous Flow Method

D4591 Test Method for Determining Temperatures and Heats of Transitions of Fluoropolymers by Differential Scanning Calorimetry

D4895 Specification for Polytetrafluoroethylene (PTFE) Resin Produced From Dispersion

D5033 Guide for Development of ASTM Standards Relating to Recycling and Use of Recycled Plastics (Withdrawn 2007)⁴

D5740 Guide for Writing Material Standards in the Classification Format

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

2.2 ISO Standards:⁵

ISO 12086-1 Plastics-Fluoropolymer Dispersions and Moulding and Extrusion Materials Part 1: Designation and System and Basis for Specification

ISO 12086-2 Plastics-Fluoropolymer Dispersions and Moulding and Extrusion Materials Part 2: Preparation of Test Specimens and Determination of Properties

3. Terminology

3.1 *Definitions:* The terminology given in Terminology **D883** is applicable to this classification unless otherwise specified.

⁴ The last approved version of this historical standard is referenced on www.astm.org.

⁵ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

3.1.1 *bulk density, n*—the mass per unit volume, in grams per litre of a loosely packed material, such as a molding powder. **D4895**

3.1.2 *lot, n*—one production run or uniform blend of two or more production runs. **D4895**

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *direct polymerization powder, n*—PTFE material based on polymerizations designed to produce low molecular weight PTFE resins with properties of materials described in this standard.

3.2.2 *dispersion-based powder, n*—PTFE material based on the type of polymerization normally related to the production of “paste or coagulated dispersion type” PTFE resins.

3.2.3 *micropowder, n*—white, free-flowing PTFE powders designed for use as additives in other materials or systems.

3.2.4 *reground PTFE, n*—PTFE material produced by grinding polytetrafluoroethylene (PTFE) material that has been preformed but has never been sintered.

3.2.5 *reprocessed PTFE, n*—PTFE material produced by grinding PTFE material that has been both preformed and sintered.

3.2.6 *sintering, n*—as it applies to PTFE, a thermal treatment during which the PTFE is melted and recrystallized by cooling, with coalescence occurring during the treatment.

3.2.7 *suspension-based powder, n*—PTFE material based on the type of polymerization normally related to the production of granular PTFE resins.

3.3 *Abbreviations*—Abbreviated terms are in accordance with Terminology **D1600**.

4. Classification

4.1 This classification covers two groups of fluoropolymer micropowders. Fluoropolymer micropowders are classified into groups according to their base fluoropolymer. These groups are further subdivided into classes and grades as shown in **Table 1**.

NOTE 1—An example of this classification system is as follows: The designation ASTM D5675 PTFE0111 indicates PTFE micropowder in accordance with Specification D5675:

- 01 = PTFE resin,
- 1 = suspension polymerization based, and
- 1 = formerly Type I, Grade 1, Class A, in Specification D5675 - 95a with a particle size of 1 to <10 µm (average diameter), a surface area of 0.8 to 4.5 m²/g, and a mass flow rate of >1 g/10 min using a load of 5 kg.

5. General Requirements

5.1 The resin shall be uniform and shall contain no additives or foreign material.

5.2 The color of the material as shipped by the seller shall be white to gray.

6. Sampling

6.1 Sampling shall be statistically adequate to satisfy the requirements of **9.4**.

7. Sample Preparation

7.1 *Test Samples:*

TABLE 1 Basic Properties

| Group | Description | Class | Description | Grade | Description | Particle Size, Average Diameter, µm | Surface Area, m ² /g | Melt-Flow Rate, ^A g/10 min | Mass ^B | |
|-----------------|-----------------|-----------------------|------------------|----------|-------------|-------------------------------------|---------------------------------|---------------------------------------|-------------------|---|
| 01 ^C | PTFE | 1 | suspension based | 1 | <i>D</i> | 1 to <10 | 0.8 to 4.5 | >1 | 5 | |
| | | | | 2 | <i>E</i> | 10 to 25 | 0.8 to 4.5 | >0.1 | 10 | |
| | | 2 | dispersion based | 1 | <i>F</i> | 1 to <10 | 4.6 to 15 | >1 | 5 | |
| | | | | 2 | <i>G</i> | 10 to 30 | 4.6 to 15 | >0.1 | 10 | |
| | | | | 3 | <i>H</i> | 25 to 50 | 4.6 to 15 | >1 | 5 | |
| | | | | 4 | <i>I</i> | 50 to 150 | 4.6 to 15 | >1 | 5 | |
| | 3 | direct polymerization | 1 | <i>J</i> | 2 to 15 | 4.6 to 15 | >1 | 5 | | |
| | | | 4 | <i>K</i> | 1 to <10 | 0.8 to 4.5 | >1 | 5 | | |
| | 5 | reground dispersion | 1 | <i>L</i> | 1 to 25 | 0.8 to 4.5 | >1 | 5 | | |
| | | | 6 | <i>M</i> | 10 to 50 | <1.5 | >20 | 5 | | |
| | 02 ^N | FEP | 1 | | 1 | <i>O</i> | 10 to 30 | 4.6 to 15 | 4 to 12 | 5 |

^AOrifice diameter of 2.0955 mm and temperature of 372°C.

^BKilogram load on plastometer.

^CGroup 01 materials have a specific gravity of 2.10 to 2.30 g/cm³, a water content (maximum) of <0.1 %, a melting point (peak temperature) of 315 to 340°C, and a bulk density of 225 to 600 g/L.

^DFormerly Specification D5675–95a, Type I, Grade 1, Class A.

^EFormerly Specification D5675–95a, Type I, Grade 1, Class B.

^FFormerly Specification D5675–95a, Type I, Grade 2, Class A.

^GFormerly Specification D5675–95a, Type I, Grade 2, Class B.

^HFormerly Specification D5675–95a, Type I, Grade 2, Class C.

^IFormerly Specification D5675–95a, Type I, Grade 2, Class D.

^JFormerly Specification D5675–95a, Type I, Grade 3, Class A.

^KFormerly Specification D5675–95a, Type I, Grade 4, Class A.

^LFormerly Specification D5675–95a, Type I, Grade 4, Class B.

^MFormerly Specification D5675–95a, Type I, Grade 5, Class A.

^NGroup 02 materials have a specific gravity of 2.10 to 2.20 g/cm³, a water content (maximum) of <0.1 %, a melting point (peak temperature) of 250 to 280°C, and a bulk density of 200 to 600 g/L.

^OFormerly Specification D5675–95a, Type II, Grade 1, Class A.