



Designation: D6339 – 05

# Standard Specification for Syndiotactic Polystyrene Molding and Extrusion (SPS)<sup>1</sup>

This standard is issued under the fixed designation D6339; 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 specification covers syndiotactic polystyrene materials including homopolymer, copolymers, blends, and impact modified, suitable for molding and extrusion. Recycled product will be addressed in a separate standard.

1.2 This specification is intended to be a means of calling out plastic materials used in fabrication of end use items or parts. Material selection should be made by those having expertise in the plastics field after careful consideration of the design and the performance required of the part, the environment to which it will be exposed, the fabrication process to be employed, the inherent properties of the material other than those covered by this specification, and the economics.

1.3 The properties included in this specification are those required to identify the compositions covered. Other requirements necessary to identify particular characteristics important to specialized applications can be called out using the suffixes given in Section 5.

NOTE 1—There is no ISO equivalent.

## 2. Referenced Documents

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

- D256 Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
- D618 Practice for Conditioning Plastics for Testing
- D638 Test Method for Tensile Properties of Plastics
- D648 Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position
- D790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
- D792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
- D883 Terminology Relating to Plastics
- D1238 Test Method for Melt Flow Rates of Thermoplastics

<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.

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<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.

by Extrusion Plastometer

D1525 Test Method for Vicat Softening Temperature of Plastics

D1898 Practice for Sampling of Plastics

D3641 Practice for Injection Molding Test Specimens of Thermoplastic Molding and Extrusion Materials

D3892 Practice for Packaging/Packing of Plastics

D4000 Classification System for Specifying Plastic Materials

D5630 Test Method for Ash Content in Plastics

2.2 Military Standard:<sup>3</sup>

MIL-STD-105 Sampling Procedure and Tables for Inspection by Attributes

2.3 ISO Standards:<sup>4</sup>

ISO 75-1 and 2 Plastics: Determination of Temperature of Deflection Under Load

ISO 179-1 Determination of Charpy Impact Strength—Part 1: Non-Instrumented Impact Test

ISO 306 Plastics: Thermoplastic Materials—Determination of Vicat Softening Temperature (VST)

ISO 527-2 Plastics: Determination of Tensile Properties—Part 2: Test Conditions for Moulding and Extrusion Plastics

ISO 1133 Plastics—Determination of the Melt Mass-Flow Rate (MFR) and the Melt Volume-Flow Rate (MVR) of Thermoplastics

ISO 1183 Plastics: Methods for Determining the Density and Relative Density of Non-Cellular Plastics

ISO 3451 Plastics: Determination of Ash—Part 1 General Methods

## 3. Terminology

3.1 *Definitions*—For definitions of technical terms pertaining to plastics used in this specification, see Terminology D883.

## 4. Classification

4.1 Syndiotactic polystyrene materials are classified into groups according to classes and grades shown in the basic properties table, Table SPS. Injection molded properties are the

<sup>3</sup> Available from Standardization Documents Order Desk, Bldg. 4 Section D, Philadelphia, PA, 199111-5094, Attn: PODS.

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

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

preferred standard and are used for the basis of call out examples. Call outs can be made in either ASTM or ISO properties where both are given using the same line callout.

NOTE 2—An example of this classification system for SPS is as follows: For SPS0111, the designation SPS would indicate SPS = syndiotactic polystyrene = homopolymer = general purpose, and 1 (grade) = minimum grade requirements as found in Table SPS.

4.1.1 To facilitate the incorporation of future or special materials the “Other/Unspecified” category (0) for group, class, and grade is shown in Table SPS. The basic properties can be obtained from Tables A or B as they apply (see 4.3).

4.2 Reinforced and filled syndiotactic polystyrene materials are classified in accordance with Table SPS as noted or with Table A.

4.2.1 *Reinforced and Additive Materials*—A single letter will be used for the major reinforcement or combination, or both, along with two digits that indicate the percentage of addition by mass with the tolerances as shown in Table 1.

NOTE 3—This part of the system uses the type and percentages of additive to designate the modification of the basic material. Percentage of additives can be shown on the supplier’s Technical Data Sheet unless it is proprietary. If necessary, additional requirements shall be indicated by the use of the suffix part of the system, as given in Section 5.

NOTE 4—Determine ash content of filled or reinforced materials using Test Method D5630 or ISO 3451–1 where applicable.

4.2.2 *Table A, Detail Requirements*—An identifying number is made up of the letter A and five digits comprising the cell numbers for the new requirements in the designated order as they appear in Table A.

4.2.2.1 Although the values listed are necessary to include the range of properties available in existing materials, users should not infer that every possible combination of the properties exists or can be obtained.

NOTE 5—Using Table SPS and Table A, an example of a reinforced syndiotactic polystyrene of this classification system is as follows: The designation would indicate material requirements from Table A as:

SPS0110G15A12332

where:

- 0110 = Homopolymer, Table SPS,
- G15 = Glass-reinforced at 15 % nominal (see 4.2.1),
- A = Table A for property requirements,
- 1 = Tensile strength 50 MPa,
- 2 = Flexural modulus or tensile modulus (ISO), 4000 MPa/min,
- 3 = Izod impact 70 J/m or 7 kJ/m<sup>2</sup>(Charpy ISO), minimum,
- 3 = Deflection temperature, 180°C, minimum, and
- 2 = Specific gravity, 1.2, minimum.

If no properties are specified, the designation would be SPS0110G15A00000.

4.3 Table B has been incorporated into this specification to facilitate the classification of special materials where neither Table SPS nor Table A reflect the required properties. Table B shall be used in the same manner as Table A.

NOTE 6—An example of a special material using this classification system is as follows: The following designation would indicate material requirements from Table B as:

SPS0110B76013

where:

- 0110 = homopolymer from Table SPS,

- B = Cell Table B for properties requirements,
- 7 = Tensile strength, 70 MPa, minimum,
- 6 = Tensile Modulus, 3500 MPa, minimum,
- 0 = Unspecified Izod impact/ISO Charpy impact,
- 1 = Vicat softening temperature, 80°C, minimum, and
- 3 = Flow rate, 3.0, minimum.

## 5. Suffix Requirements

5.1 When requirements are needed that supersede or supplement the property table or cell table requirements they shall be specified through the use of suffixes. In general, the first suffix letter indicates the special requirements needed and the second letter indicates the condition or test method, or both, with a three-digit number indicating the specific requirement. The suffixes that may be used are listed in Table 3 of Classification D4000.

NOTE 7—Properties of pigmented or colored SPS materials can differ from the properties of natural or unpigmented SPS material, depending on the choice of colorants and the concentration. The main property affected is ductility, as illustrated by a reduction in Izod impact strength. If specific properties of pigmented SPS materials are necessary, prior testing between the materials supplier and end user should be initiated.

## 6. Basic Requirements

6.1 Basic requirements from Table SPS, as they apply, are always in effect unless these requirements are superseded by specific suffix requirements, which always take precedence.

## 7. General Requirements

7.1 The material composition shall be uniform and shall conform to the requirements specified herein.

## 8. Detail Requirements

8.1 Test specimens for the various materials shall conform to the requirements prescribed in Tables SPS, A, and B, and suffix requirements as they apply.

8.2 For the purpose of determining conformance, all specified limits for a specification (line callout) based on this classification system are absolute limits.

## 9. Sampling

9.1 Sampling shall be in accordance with a sampling procedure statistically adequate to satisfy the requirements of 13.4. A lot of material shall be considered as a unit of manufacture as prepared for shipment, and may consist of two or more production runs or batches.

## 10. Sample Preparation—Injection

10.1 The test specimens shall be molded by an injection molding process in accordance with Practice D3641 as follows:

10.1.1 Pre-drying of pellets is only required for blends of SPS. Four hours of drying at 200°C in a dryer with a dew point of –30°C is recommended for SPS/PA blends.

10.1.2 For injection-molded samples 290 ± 10°C shall be the melt temperature, and 100 ± 10°C or 160 ± 10°C for filled or reinforced materials, shall be the mold temperature.

10.1.2.1 Average injection velocity shall be 200 ± 100 mm/s, and can be calculated using the following equation:

$$AIV = \frac{\pi d^2 Va}{4ns} \quad (1)$$

where:

- $d$  = screw diameter,
- $V_a$  = screw advance speed,
- $n$  = number of mold cavities, and
- $s$  = cross-sectional area of test specimen.

## 11. Conditioning

11.1 Test specimens shall be conditioned in the standard laboratory atmosphere in accordance with Procedure A of Practice **D618** before performing the required tests. Blends shall be tested dry as molded.

11.2 Conduct tests in the standard laboratory atmosphere of  $23 \pm 2^\circ\text{C}$  and  $50 \pm 5\%$  relative humidity in accordance with Practice **D618**.

## 12. Test Methods

12.1 Unless otherwise stated herein, determine the properties enumerated in this specification by means of the following Test Methods as applicable: **D256** or ISO 179; **D638** or ISO 527; **D648** or ISO 75; **D790**; **D792** or ISO 1183; **D1238** or ISO 1133; **D1525** or ISO 306.

## 13. Inspection and Certification

13.1 Inspection and certification of the material supplied under this standard specification shall be for conformance to the requirements specified herein.

13.2 Lot-acceptance inspection shall be the basis on which acceptance or rejection of the lot is made. The lot-acceptance inspection shall consist of the following:

- 13.2.1 Tensile strength, and
- 13.2.2 Ash (filled products only).

13.3 Periodic-check inspection with reference to a specification based upon this classification system shall consist of the tests for all requirements of the material under this specification. Inspection frequency shall be adequate to ensure material is certifiable in accordance with **13.4**.

13.4 Certification shall be that the material was manufactured by a process in statistical control, sampled, tested and inspected in accordance with this classification system and that the average values for the lot meet the requirements of the line callout specified.

13.5 A report of the test results shall be furnished when requested. The report shall consist of results of the lot-acceptance inspection for the shipment and results of the most recent periodic-check inspection.

## 14. Packaging and Package Marking

14.1 For packing, packaging, and marking, the provisions of Practice **D3892** apply.

## 15. Keywords

- 15.1 plastics; syndiotactic polystyrene

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