



Designation: D4549 – 15

# Standard Classification System and Basis for Specification for Polystyrene and Rubber-Modified Polystyrene Molding and Extrusion Materials (PS)<sup>1</sup>

This standard is issued under the fixed designation D4549; 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 U.S. Department of Defense.*

## 1. Scope\*

1.1 This classification system covers polystyrene materials, both crystal and rubber modified, suitable for molding and extrusion.

1.2 This classification system and subsequent line callout (specification) are intended to be a means of calling out plastic materials used in the fabrication of end items or parts. It is not intended for the selection of materials. Material selection can 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 are to be specified using the suffixes as given in Section 5.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

NOTE 1—This standard combines elements from ISO 1622-1-2 and ISO 2897-1-2, but is not equivalent to either ISO standard.

## 2. Referenced Documents

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

**D256** Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics

**D638** Test Method for Tensile Properties of Plastics

<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.

Current edition approved Sept. 1, 2015. Published September 2015. Originally approved in 1985. Last previous edition approved in 2011 as D4549 – 11. DOI: 10.1520/D4549-15.

<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.

**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 by Extrusion Plastometer

**D1525** Test Method for Vicat Softening Temperature of Plastics

**D1600** Terminology for Abbreviated Terms Relating to Plastics

**D3892** Practice for Packaging/Packing of Plastics

**D4000** Classification System for Specifying Plastic Materials

**D5630** Test Method for Ash Content in Plastics

**E29** Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

Manual on Presentation of Data and Control Chart Analysis, 8th Edition, Catalog Number: MNL7-8TH-EB

### 2.2 ISO Standards:<sup>3</sup>

**ISO 1622-1-2** Polystyrene (PS) Molding and Extrusion Materials—Part 1: Designation System and Basis for Specifications

**ISO 1622-2** Polystyrene (PS) Molding and Extrusion Materials—Part 2: Preparation of Test Specimens and Determination of Properties

**ISO 2897-1** Impact-Resistant Polystyrene (PS-I) Molding and Extrusion Materials—Part 1: Designation System and Basis for Specifications

**ISO 2897-2** Impact-Resistant Polystyrene (PS-I) Molding and Extrusion Materials—Part 2: Preparation of Test Specimens and Determination of Properties

## 3. Terminology

3.1 *Definitions*—The terminology used in this classification system is in accordance with Terminologies **D883** and **D1600**.

<sup>3</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

4. Classification

4.1 Polystyrene materials are classified into groups in accordance with classes and grades as shown in the basic property table (Table PS). Injection molded properties are the preferred standard and are used for the basis of call out examples.

NOTE 2—Since compression molded properties have been removed from the standard with this publication, refer to previous publications of this standard, if interested in these properties.

NOTE 3—An example of this classification system for PS0111 is as follows: The designation PS0111 would indicate: PS = polystyrene as found in Terminology D1600, 01 (group) = crystal polystyrene, 1 (class) = general-purpose, and 1 (grade) = minimum-grade requirements as found in Table PS.

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 PS. The basic properties are obtained from Tables A or B as they apply (see 4.3).

4.2 Reinforced and filled polystyrene materials are classified in accordance with Table PS and Table A. Table PS specifies unreinforced material and Table A the properties after addition of reinforcements or lubricants at the normal levels indicated (see 4.2.1).

4.2.1 Reinforcements 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 tabulated as follows:

Symbol	Material	Tolerance (Based on Total Mass)
C	Carbon and graphite fiber-reinforced	± 2 %
G	Glass	± 2 %
M	Mineral-reinforced	± 2 %
L	Lubricants	Depends upon material and process to be specified
R	Combination of reinforcement or fillers, or both	± 2 %

NOTE 4—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 5—Determine ash content of filled or reinforced materials using Test Method D5630 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, not every possible combination of the properties exists or can be obtained.

NOTE 6—An example of a reinforced polystyrene of this classification system is as follows: The designation PS0110G15A12332 would indicate the following material requirements from Table A:

- 0110 = Polystyrene, crystal, from Table PS,
  - G15 = Glass-reinforced at 15 % nominal (see 4.2.1),
  - A = Table A for property requirements,
  - 1 = Tensile strength, 50 MPa, min,
  - 2 = Flexural modulus, 4200 MPa, min,
  - 3 = Izod impact, 40 J/m, min,
  - 3 = Deflection temperature, 102°C, min, and
  - 2 = Specific gravity, 1.2, min.
- If no properties are specified, the designation would be PS0110G15-A00000.

4.3 Table B has been incorporated into this specification to facilitate the classification of special materials where Table PS or Table A does not reflect the required properties. Tables shall be used in the same manner as Table A.

NOTE 7—An example of a special material using this classification system is as follows: The designation PS0110B76013 indicates the following, with the material requirements from Table B:

- PS0110 = Polystyrene, crystal, from Table PS,
- B = Cell Table B for property requirements,
- 7 = Tensile strength, 70 MPa, min,
- 6 = Tensile modulus, 2700 MPa, min,
- 0 = Unspecified Izod impact
- 1 = Vicat softening temperature, 85°C, min, and
- 3 = Flow rate, 3.0, min.

TABLE PS Polystyrene Materials, Detail Requirements, Natural Color Only

Group	Description	Class	Description	Grade	Description	Melt Flow Rate, ASTM D1238, Con- dition 200/5.0 g/10 min, min <sup>A</sup>	Izod Impact, (12.7 by 3.2 mm) ASTM D256, min, J/m <sup>B</sup>	Tensile Strength at Yield, ASTM D638, min, MPa <sup>C, D</sup>	Tensile Modulus, ASTM D638, min, MPa <sup>D</sup>	Vicat Softening Point, ASTM D1525, Rate B, °C, min 1000-g load					
						Injection molded	Injection molded	Injection molded	Injection molded	Injection molded					
01	Crystal	1	General-Purpose	1		1.0		45	3100	100					
						5.0		40	3000	95					
						10.0		35	2900	85					
02	Rubber-modified	1	Other	0	Other	Unspecified				Unspecified					
						1	Medium-impact	1	1.0	40	34	2500	95		
								2	5.0	40	28	2300	90		
								3	10.0	40	22	2000	85		
						2	High-impact	0	Other	Unspecified					Unspecified
										1	1.0	80	20	2000	95
										2	5.0	80	18	1800	90
										3	10.0	80	16	1600	85
						3	Super-high-impact	0	Other	Unspecified					Unspecified
										1	1.0	120	14	1400	90
2	5.0	120	12	1200	85										
00	Other	0	Other	0	Other	Unspecified				Unspecified					

<sup>A</sup>Use pellets, powder, or parts cut into pieces that can fit into the barrel.

<sup>B</sup>Method A, specimen are nominal 3.2-mm thick injection-molded and taken from the center of Type I (D638) specimen.

<sup>C</sup>Values in this column for crystal PS are not yield, but break strengths; crystal PS does not exhibit a yield point.