



Designation: D 4549 – 00

Standard Specification for Polystyrene and Rubber-Modified Polystyrene Molding and Extrusion Materials (PS)¹

This standard is issued under the fixed designation D 4549; 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 specification covers polystyrene materials, both crystal and rubber modified, suitable for molding and extrusion. Recycled polystyrene products are addressed in Specification D 5676.

1.2 This specification is intended to be a means of calling out plastic materials used in the fabrication of end 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 as given in Section 5.

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:

- D 256 Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics²
- D 618 Practice for Conditioning Plastics for Testing²
- D 638 Test Method for Tensile Properties of Plastics²
- D 648 Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position²
- D 790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials²
- D 792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement²
- D 883 Terminology Relating to Plastics²
- D 1238 Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer²

¹ 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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² *Annual Book of ASTM Standards*, Vol 08.01.

- D 1525 Test Method for Vicat Softening Temperature of Plastics²
- D 1600 Terminology for Abbreviated Terms Relating to Plastics²
- D 2584 Test Method for Ignition Loss of Cured Reinforced Resins³
- D 3892 Practice for Packaging/Packing of Plastics³
- D 4000 Classification System for Specifying Plastic Materials³
- D 5676 Specification for Recycled Polystyrene Molding and Extrusion Materials⁴
- E 105 Practice for Probability Sampling of Materials⁵
- 2.2 *ISO Standards*:⁶
 - ISO 1622-1-2 Polystyrene (PS) Molding and Extrusion Materials
 - ISO 2897-1-2 Impact Resistant Polystyrene (PS-I) Molding and Extrusion Materials

3. Terminology

3.1 *Definitions* — For definitions of technical terms pertaining to plastics used in this specification, see Terminology D 883.

4. Classification

4.1 Polystyrene materials are classified into groups according to 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 D 1600, 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,

³ *Annual Book of ASTM Standards*, Vol 08.02.

⁴ *Annual Book of ASTM Standards*, Vol 08.03.

⁵ *Annual Book of ASTM Standards*, Vol 14.02.

⁶ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.



and grade is shown in Table PS. The basic properties can be 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—Ash content of filled or reinforced materials may be determined using Test Method D 2584 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 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-A0000.

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 would indicate 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.

ASTM D4549-00

TABLE PS Polystyrene Materials, Detail Requirements, Natural Color Only

Group	Description	Class	Description	Grade	Description	Melt Flow Rate, ASTM D 1238, Condition 200/5.0 g/10 min, min ^A	Izod Impact, (12.7 by 3.2 mm) ASTM D 256, min, J/m ^B	Tensile Strength at Yield, ASTM D 638, min, MPa ^{C,D}	Tensile Modulus, ASTM D 638, min, MPa ^D	Vicat Softening Point, ASTM D 1525, Rate B, °C, min 1000-g load			
						Injection molded	Injection molded	Injection molded	Injection molded	Injection molded			
01	Crystal	1	General-Purpose	1	Other	1.0	40	45	3100	100			
				2		5.0		40		95			
				3		10.0		35		85			
02	Rubber-modified	1	Other	0	Other	Unspecified	40	34	2500	Unspecified			
				1		1.0				28	95		
				2		5.0				22	90		
		2	High-impact	2	Other	3	Other	10.0	80	18	1600	85	
						0		Unspecified				20	95
						1		1.0				18	90
						2		5.0				16	85
		3	Super-high-impact	3	Other	0	Other	10.0	120	14	1200	90	
						1		1.0				12	85
						2		5.0					
00	Other	0	Other	0	Other	Unspecified	120	12	1200	Unspecified			
				0		Unspecified							

^A Specimen may be pellets, powder, or parts cut into pieces that can fit into the barrel.
^B Method A, specimen are nominal 3.2-mm thick injection-molded and taken from the center of Type I (D 638) specimen.
^C Values in this column for crystal PS are not yield, but break strengths; crystal PS does not exhibit a yield point.
^D Tensile properties determined on nominal 3.2-mm thick injection-molded Type I specimen tested at 5 mm/min.