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AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Specification for PROPYLENE PLASTIC MOLDING AND EXTRUSION MATERIALS[1]

This standard is issued under the fixed designation D 2146; 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 requirements for propylene molding and extrusion materials compounded with or without the addition of modifiers, colorants, stabilizers, or lubricants. It provides for their identification in such a manner that the seller and the purchaser can agree on the substantial similarity of different commercial lots or shipments. It is not the function of this specification to provide engineering or design data.

NOTE 1—The properties included in this specification are those required to identify the types of molding and extrusion material covered. There may be other requirements necessary to identify particular characteristics. These will be added to the specification as their inclusion becomes generally desirable and the necessary test data and methods become available.

2. Applicable Documents

2.1 *ASTM Standards*:

D 256 Tests for Impact Resistance of Plastics and Electrical Insulating Materials[2]

D 257 Tests for D-C Resistance or Conductance of Insulating Materials[2]

D 618 Conditioning Plastics and Electrical Insulating Materials for Testing[3]

D 621 Tests for Deformation of Plastics Under Load[4]

D 638 Test for Tensile Properties of Plastics[4]

D 759 Recommended Practice for Conducting Physical Property Tests of Plastics at Subnormal and Supernormal Temperatures[4]

D 792 Tests for Specific Gravity and Density of Plastics by Displacement[4]

D 1238 Test for Flow Rates of Thermoplastics by Extrusion Plastometer[4]

D 1505 Test for Density of Plastics by the Density-Gradient Technique[4]

D 1531 Test for Dielectric Constant and Dissipation Factor of Polyethylene by Liquid Displacement Procedure[5]

D 1897 Recommended Practice for Injection Molding Test Specimens of Thermoplastic Molding and Extrusion Materials[4]

D 1898 Recommended Practice for Sampling of Plastics[4]

D 3892 Practice for Packaging/Packing of Plastics[4]

2.2 *Military Standard*:

MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes[6]

3. Classification

3.1 *Types*—This specification covers two types of propylene molding and extrusion materials, classified according to basic composition:

3.1.1 *Type I*—Polypropylene, characterized by its rigidity and resistance to deformation under load (915 kg/m^3 density, maximum, based on uncolored, unfilled plastic).

3.1.2 *Type II*—Propylene copolymers and propylene-elastomer compounds, characterized

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[2] *Annual Book of ASTM Standards*, Parts 35, 38, and 39.

[3] *Annual Book of ASTM Standards*, Parts 22, 35, and 39.

[4] *Annual Book of ASTM Standards*, Part 35.

[5] *Annual Book of ASTM Standards*, Parts 39 and 40.

[6] Available from Naval Publications and Forms Center, 5801 Tabor Ave., Philadelphia, Pa. 19120.

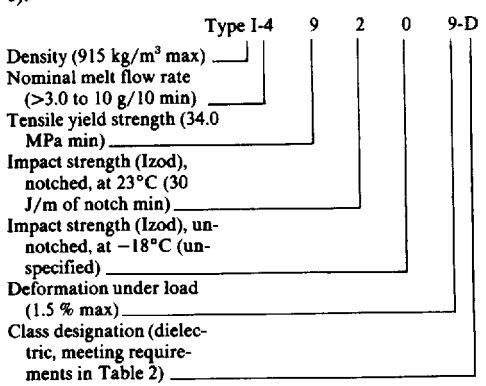
by improved resistance to impact, especially at low temperatures (915 kg/m^3 density, maximum, based on uncolored, unfilled plastic).

3.2 *Grades*—Each of the types is subdivided into grades according to physical properties. The specification provides a system for characterization and identification, which enables coverage for all commercially available grades having properties within the range of the possible combinations that may be selected from Table 1. A grade is designated by the cell numbers for each property in the order in which they are listed in Table 1. When a property is not specified, a "0" is entered as the cell number.

3.3 *Classes*—Each of the types and grades may be further subdivided into classes according to special requirements. A class is designated by the letter corresponding to the requirements detailed in Table 2. Where no special requirements in addition to type and grade properties are needed, no class designation is shown.

3.4 Identity of a specific material is made by a code designation indicating type, grade, and class designations in sequence, with dashes between the type and first property designations, and between the last property and class designation.

NOTE 2—An example of this classification system would be I-49209-D, an unmodified type of polypropylene having the following requirements (see Table 1):



NOTE 3—The cell-type format as applied to the grade requirements provides the means for close characterization and specification of each property and combination of properties for a broad range of materials. This type format, however, is subject to possible misapplication since impossible property combinations can be coded if the user is not familiar with available commercial materials.

4. Ordering Information

4.1 The purchase order or inquiry for these materials shall state the specification number, the date of issue, the type, grade, and, if needed, the appropriate class, for example, ASTM D 2146 – 77: I-49209-D.

4.2 Further definition, as may be required for the following shall be on the basis of agreement between the seller and the purchaser:

4.2.1 Nominal flow rate.

4.2.2 Antioxidant or other additive and proportions.

4.2.3 Color (see 5.3).

4.2.4 Contamination level (see 5.2).

4.2.5 Particle size.

4.2.6 Other supplementary definition unless grade is sufficient.

4.2.7 Inspection (see 11.1).

5. Materials and Manufacture

5.1 The molding and extrusion material shall be propylene plastic in the form of powder, granules, or pellets.

5.2 The molding and extrusion material shall be of uniform composition and size and shall be free of foreign matter to such contamination level as may be agreed between the seller and the purchaser.

5.3 The color and translucence of molded or extruded pieces, formed under conditions recommended by the manufacturer of the materials, shall be comparable within commercial match tolerances to the color and translucence of standard molded or extruded samples of the same thickness supplied in advance by the manufacturer of the material.

6. Physical Requirements

6.1 Test specimens molded by injection in accordance with the procedures of 9.1 and tested as specified in 10.1 shall conform to the requirements for density, tensile yield strength, impact strength, and deformation under load as prescribed in 3.1 and Table 1 for the type and grade specified.

6.2 The material in the form of molding powder, granules, or pellets shall have a nominal flow rate as specified by its grade designation and the corresponding requirements in Table 1. In view of production and sampling and testing variables, a commercial lot or shipment shall be considered as conforming and

commercially acceptable when the flow rate found on a sample from the lot or shipment falls within ±30 % of the nominal flow rate.

6.3 The material in accordance with its class designation shall conform to the detail requirements prescribed in Table 2.

7. Sampling

7.1 A batch or lot shall be considered as a unit of manufacture and may consist of a blend of two or more production runs of material.

7.2 Unless otherwise agreed between the seller and the purchaser, the material shall be sampled in accordance with the procedure described in Sections 9 through 12 of Recommended Practice D 1898. Adequate statistical sampling prior to packaging shall be considered an acceptable alternative.

8. Testing

8.1 The requirements identified by the material designation and otherwise specified in the purchase order (see 4.1 and 4.2) shall be verified by tests made in accordance with the directions given in 10.1. For routine inspection only flow rate and tensile yield strength for Type I and flow rate, tensile yield strength, and impact strength at 23°C for Type II will be performed by the manufacturer on each shipment unless otherwise specified by the purchaser in the contract or order. One sample shall be sufficient for testing each batch or lot provided that the average values for all of the tests made on that batch or lot comply with the specified requirements.

9. Specimen Preparation

9.1 Unless otherwise agreed between the seller and the purchaser, test specimens shall be injection molded in accordance with the following specific procedures and Recommended Practice D 1897.

NOTE 4—Physical and mechanical properties are dependent upon the technique of specimen preparation. Specimen preparation by means other than those described below can lead to significant variation in test results and thus cause departure from specification values.

9.1.1 *Specimen*—A Type I tension test specimen (Method D 638) with a thickness of 3.1 mm (0.120 in.) minimum to 3.3 mm (0.130 in.) maximum shall be molded in a single-cavity operation. Use of a multi-cavity mold is an acceptable alternative provided that it can be shown that the properties of specimens so prepared are comparable with those obtained by single-cavity molding. Cavity gate dimensions for the specimen shall be 2.5 by 2.5 mm (0.10 by 0.10 in.) min to 3.2 by 6.4 mm (0.125 by 0.250 in.) max. Weight of the complete injection molded shot, including specimen, runner, and sprue, shall be 25 ± 10 % of the rated capacity of the heating cylinder.

9.1.2 *Mold Temperature*—The temperature of the mold shall be 60 ± 3°C (140 ± 5°F). Temperature measurements shall be made with a surface-type pyrometer, or equivalent, to an accuracy of ±2°C (3.6°F), after equilibrium "on cycle" conditions have been established.

9.1.3 *Cycle*—Molding cycle time shall be 45 s total with 20 s plunger forward (including 1 to 5 s dead time), 20 s cooling, and 5 s mold open.

9.1.4 *Stock Temperature*—The stock temperature for the molding of test specimens shall be 60 ± 5°C (108 ± 9°F) higher than the fill-point temperature. The fill-point temperature is defined as the *minimum* stock temperature that will give complete cavity fill when operating on cycle under the conditions detailed in 9.1.1 through 9.1.3 and with the injection pressure set at 80 % of the maximum capacity of the machine. Stock temperature shall be measured on cycle by taking the temperatures of several successive free shots with a needle-type pyrometer to an accuracy of ±3°C (5.4°F). The needle should be moved about in the plastic mass, and a sufficient number of measurements shall be made to establish a reliable result. To minimize heat loss from the plastic during measurement, the mass should be collected in a heated container or in one made from material of low thermal conductivity. The quantity of plastic in the free shot should be controlled to be equivalent to the weight of a complete injection-molded shot.

9.1.5 *Injection Pressure*—For molding test specimens, the injection pressure shall be set at the maximum allowable level that does not produce excessive flash in the test section of the specimen. For full utilization of available machine pressure, care should be taken to align and position the mold for tight closure.

9.1.6 *Booster*—A high-volume booster pump shall not be used.