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Plastics — Designation of impact-resistant polystyrenes

Matières plastiques — Désignation des polystyrènes résistants au choc

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up has the right to be represented on that Committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 2897 was drawn up by Technical Committee ISO/TC 61, *Plastics*, and circulated to the Member Bodies in September 1972.

It has been approved by the Member Bodies of the following countries :

Austria	Israel	Sweden
Belgium	Japan	Switzerland
Brazil	Netherlands	Thailand
Canada	New Zealand	Turkey
Czechoslovakia	Poland	United Kingdom
Egypt, Arab Rep. of	Portugal	U.S.A.
Germany	Romania	U.S.S.R.
Hungary	South Africa, Rep. of	
India	Spain	

The Member Body of the following country expressed disapproval of the document on technical grounds :

France

Plastics – Designation of impact-resistant polystyrenes

1 SCOPE AND FIELD OF APPLICATION

1.1 This International Standard specifies a method of designation, and general requirements, for impact-resistant polystyrene moulding and extrusion materials; it is intended to be the basis for a full specification to be published later.

1.2 The types of impact-resistant polystyrene moulding and extrusion materials are differentiated from one another by appropriate levels of selected specific properties. Impact-resistant polystyrene itself is described by general characteristics selected for reference purposes.

1.3 These types are uncoloured or coloured materials comprising polymers of styrene (possibly copolymerized with small amounts of an alkylstyrene) modified with butadiene-based rubber to obtain greater toughness, indicated by values of impact strength exceeding that for normal polystyrene as designated by ISO 1622. Lubricants, softeners, antioxidants and other additives may be present but are not further specified here.

1.4 Other properties may be necessary to specify materials for particular purposes.

2 REFERENCES

ISO 178, *Plastics – Determination of flexural properties of rigid plastics.*

ISO/R 179, *Plastics – Determination of the Charpy impact resistance of rigid plastics (Charpy impact flexural test).*

ISO/R 180, *Plastics – Determination of the Izod impact resistance of rigid plastics (Izod impact flexural tests).*

ISO/R 291, *Plastics – Standard atmospheres for conditioning and testing.*

ISO 293, *Plastics – Compression moulding test specimens of thermoplastic materials.*

ISO 306, *Plastics – Determination of the Vicat softening temperature of thermoplastics.*

ISO/R 1133, *Plastics – Determination of the melt flow rate of thermoplastics.*

ISO 1622, *Plastics – Designation for polystyrene moulding and extrusion materials.*

ISO 2557, *Plastics – Amorphous thermoplastic moulding materials – Preparation of test specimens with a defined level of shrinkage.¹⁾*

ISO 2561, *Plastics – Determination of residual styrene monomer in polystyrene by gas chromatography.*

3 DESIGNATION

3.1 Materials are codified as "SB" (to indicate polystyrene modified with butadiene) and in terms of their individual combinations of range or "cell" values of softening point, melt flow, impact strength and modulus of elasticity; for example, 132(I)4, by reference to 4.2 means:

1 – Vicat softening point ≤ 80 °C;

3 – melt flow index $> 8,0$ to 16 g/10 min;

2(I) – Izod impact strength > 30 to 60 J/m (a Charpy value is designated by 2(C));

4 – modulus of elasticity $> 2,5 \times 10^9$ N/m².

Thus, this material would be designated "SB 132(I)4". (Not every combination of range or "cell" number for each principal property is achievable at this time.)

By agreement between the supplier and the purchaser a grading of "X" may be used to indicate that a particular property has been excluded from the designation.

3.2 Impact-resistant polystyrenes are those two-phase materials in which the outer (or "continuous") phase consists of styrene polymer (possibly copolymerized with small amounts of an alkylstyrene) and the inner (or "dispersed") phase consists of an elastomer, based on butadiene, to increase resistance to impact.

1) At present at the stage of draft.

3.3 The designation is applicable to materials ready for normal use, for example containing colourants and additives for normal processing. However, their presence can affect the properties in such a way that the products may have a different numerical designation from the material without colourants and additives, in which case this must be stated.

NOTES

1 Residual monomer is principally styrene, which may be measured according to ISO 2561. Restriction of residual monomer may be required for certain purposes, such as food packaging, subject to appropriate national standards.

2 Impact-resistant polystyrenes are available, ready for processing, in a variety of particle shapes and sizes; some particles are in the form of simple geometric shapes and others are irregular. Usual dimensions are of the order of 1 to 3 mm.

4 GENERAL REQUIREMENTS

4.1 System of designation

The table in 4.2 gives codes for impact-resistant polystyrene by a "cell" type system showing, for each principal property, ranges of limiting values. These cells are characterized by numbers which, in appropriate serial combination, designate a particular material. Test method, type of test specimen, and units of test values are given.

4.1.1 Results of tests should conform to the tabulated requirements. If these results fall on the borderline between two cells, the material is to be classified by the manufacturer. Only those tests characteristic of type should be used to establish conformity of a material to type. Other properties needed for a particular use, together with the method for determination, may be identified and specified by agreement between the interested parties. Routine inspection should be limited to those properties required to identify the material to the satisfaction of the purchaser.

4.2 Principal properties

See the table below.

4.3 Secondary properties

Other properties may be similarly described, with limiting values, as required for specific applications.

5 TEST SPECIMENS

5.1 Preparation

5.1.1 Test specimens shall be moulded by compression process, conforming to ISO 293, and under conditions recommended by the manufacturer. Alternatively, test specimens shall be prepared by thermal relaxation of injection moulded specimens conforming to ISO 2557.

5.1.2 Since most mechanical properties of injection moulded specimens are affected by excessive residual stresses, it is important that these stresses be controlled. (In compression moulded specimens, such residual stresses are usually minimal but they should be controlled.) For test purposes, this control shall be accomplished by adjusting moulding conditions so that maximum shrinkage is less than 5%.

5.1.3 Shrinkage shall be evaluated according to ISO 2557.

5.2 Conditioning

Moulded test specimens shall be allowed to cool, after moulding or thermal relaxation, under standard atmospheric condition (2), namely $23 \pm 2^\circ\text{C}$ and $50 \pm 5\%$ relative humidity, specified in sub-clause 3.1 of ISO/R 291 for at least 15 h before testing.

Property	Method of test	Unit	Limiting values			
			range number			
			1	2	3	4
Vicat softening point	ISO 306 (5 kg load) 50 °C/h	°C	≤ 80	> 80 to 90	> 90 to 100	> 100
Melt flow index	ISO/R 1133 (procedure 8)	g/10 min	≤ 4,0	> 4,0 to 8,0	> 8,0 to 16	> 16
Impact strength Izod (notched) or Charpy (unnotched)	ISO/R 180 ¹⁾ ISO/R 179 ²⁾	J/m kJ/m ²	> 15,0 to 30 ≤ 15	> 30 to 60 > 15 to 30	> 60 to 120 > 30 to 60	> 120,0 > 60
Modulus of elasticity	ISO 178 ³⁾	GN/m ²	≤ 1,5	> 1,5 to 2,0	> 2,0 to 2,5	> 2,5

- 1) Test specimen 63,5 mm × 12,7 mm × 6,35 mm.
- 2) Test specimen 50,0 mm × 6,0 mm × 4,0 mm.
- 3) Test specimen 80,0 mm × 10,0 mm × 4,0 mm.