# INTERNATIONAL STANDARD

# ISO 15526-2

First edition
2000-06-01

# Plastics — Polyketone (PK) moulding and extrusion materials —

## Part 2: Preparation of test specimens and determination of properties

*Plastiques — Polycétone (PK) pour moulage et extrusion —*

*Partie 2: Préparation des éprouvettes et détermination des propriétés*



Reference number
ISO 15526-2:2000(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 734 10 79
E-mail copyright@iso.ch
Web www.iso.ch

Printed in Switzerland

# Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 15526 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 15526-2 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 9, *Thermoplastic materials*.

ISO 15526 consists of the following parts, under the general title *Plastics — Polyketone (PK) moulding and extrusion materials*:

— *Part 1: Designation system and basis for specifications*

— *Part 2: Preparation of test specimens and determination of properties*

# Plastics — Polyketone (PK) moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties

## 1 Scope

This part of ISO 15526 specifies the methods of preparation of test specimens and the test methods to be used in determining the properties of polyketone moulding and extrusion materials. Requirements for handling test material and for conditioning both the test material before moulding and the specimens before testing are given here.

Procedures and conditions for the preparation of test specimens and procedures for measuring properties of the materials from which these specimens are made are given. Properties and test methods which are suitable and necessary to characterize polyketone moulding and extrusion materials are listed.

The properties have been selected from the general test methods in, ISO 10350:1993. Other test methods in wide use for or of particular significance to these moulding and extrusion materials are also included in this part of ISO 15526, as are the designatory properties specified in part 1.

In order to obtain reproducible and comparable test results, it is necessary to use the methods of preparation and conditioning, the specimen dimensions and the test procedures specified herein. Values determined will not necessarily be identical to those obtained using specimens of different dimensions or prepared using different procedures.

## 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 15526. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 15526 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 62:1999, *Plastics — Determination of water absorption.*

ISO 75-1:1993, *Plastics — Determination of temperature of deflection under load — Part 1: General test method.*

ISO 75-2:1993, *Plastics — Determination of temperature of deflection under load — Part 2: Plastics and ebonite.*

ISO 178:1993, *Plastics — Determination of flexural properties.*

ISO 179-1:—[1)], *Plastics — Determination of Charpy impact properties — Part 1: Non-instrumented impact test.*

ISO 291:1997, *Plastics — Standard atmospheres for conditioning and testing.*

ISO 294-1:1996, *Plastics — Injection moulding of test specimens of thermoplastic materials — Part 1: General principles, and moulding of multipurpose and bar test specimens.*

ISO 527-1:1993, *Plastics — Determination of tensile properties — Part 1: General principles.*

1) To be published. (Revision of ISO 179:1993)

ISO 527-2:1993, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics.*

ISO 1133:1997, *Plastics — Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics.*

ISO 1183:1987, *Plastics — Methods for determining the density and relative density of non-cellular plastics.*

ISO 2818:1994, *Plastics — Preparation of test specimens by machining.*

ISO 3146:2000, *Plastics — Determination of melting behaviour (melting temperature or melting range) of semi-crystalline polymers by capillary tube and polarizing-microscope methods.*

ISO 3167:1993, *Plastics — Multipurpose test specimens.*

ISO 3451-4:1998, *Plastics — Determination of ash — Part 4: Polyamides.*

ISO 4589-2:1996, *Plastics — Determination of burning behaviour by oxygen index — Part 2: Ambient-temperature test.*

ISO 6603-2:—[2], *Plastics — Determination of puncture impact behaviour of rigid plastics — Part 2: Instrumented impact testing.*

ISO 10350:1993[3], *Plastics — Acquisition and presentation of comparable single-point data.*

ISO 11359-2:1999, *Plastics — Thermomechanical analysis (TMA) — Part 2: Determination of coefficient of linear thermal expansion and glass transition temperature.*

ISO 15512:1999, *Plastics — Determination of water content.*

ISO 15526-1:2000, *Plastics — Polyketone (PK) moulding and extrusion materials — Part 1: Designation system and basis for specifications.*

IEC 60093:1980, *Methods of test for volume resistivity and surface resistivity of solid electrical insulating materials.*

IEC 60112:1979, *Method for determining the comparative and the proof tracking indices of solid insulating materials under moist conditions.*

IEC 60243-1:1998, *Electrical strength of insulating materials — Test methods — Part 1: Tests at power frequencies.*

IEC 60250:1969, *Recommended methods for the determination of the permittivity and dielectric dissipation factor of electrical insulating materials at power, audio and radio frequencies including metre wavelengths.*

IEC 60296:1982, *Specification for unused mineral insulating oils for transformers and switchgear.*

IEC 60695-11-10:1999, *Fire hazard testing — Part 11-10: Test flames — 50 W horizontal and vertical flame test methods.*

IEC 61006:1991, *Methods of test for the determination of the glass transition temperature of electrical insulating materials.*

---

2) To be published. (Revision of ISO 6603-2:1989)

3) ISO 10350:1993 is the normative reference, even though it has been replaced by ISO 10350-1:1998.

# 3 Preparation of test specimens

## 3.1 General

It is essential that specimens are always prepared by the same procedure (injection moulding), using the same processing conditions.

## 3.2 Treatment of the material before moulding

Before processing, the moisture content of the material sample shall not exceed 0,2 % by mass. If the moisture level exceeds this limit, the sample shall be dried in accordance with the manufacturer's instructions until the moisture content is below the limit.

## 3.3 Injection moulding

Specimens shall be prepared in accordance with ISO 294-1 using the conditions specified in Table 1.

**Table 1 — Injection-moulding conditions**

| Material | | | Moulding conditions | | | | | |
|---|---|---|---|---|---|---|---|---|
| Designation code for composition[a] | Designation code for melting temperature[a] | Filler content | Melt temperature | Mould temperature | Average injection velocity | Hold pressure | Hold pressure time | Total cycle time |
| | | % | °C | °C | mm/s | MPa | s | s |
| PK-EP | 210 | 0 to 50 | 235 | 80 | 200 ± 100 | 70 ± 10 | 15 ± 5 | ⩽ 35 |
| | 220 | | 245 | | | | | |
| | 230 | | 255 | | | | | |
| | 240 | | 265 | | | | | |
| | 250 | | 275 | | | | | |
| PK-E | 260 | | 275 | | | | | |

[a] See ISO 15526-1.

# 4 Conditioning of test specimens

After moulding, test specimens shall be conditioned in accordance with ISO 291 for between 48 h and 96 h at 23 °C ± 2 °C and (50 ± 5) % relative humidity.

# 5 Determination of properties

In the determination of properties and the presentation of data, the standards, supplementary instructions and notes given in ISO 10350:1993 shall be applied. All tests shall be carried out in the standard atmosphere of 23 °C ± 2 °C and (50 ± 5) % relative humidity unless specifically stated otherwise in the tables which follow.

Table 2 is compiled from ISO 10350:1993, and the properties listed are those which are appropriate to polyketone moulding and extrusion materials. These properties are those considered useful for comparisons of data generated for different thermoplastics.

Table 3 contains those properties, not found specifically in Table 2, which are in wide use or of particular significance in the practical characterization of polyketone moulding and extrusion materials.

**Table 2 — General properties and test conditions** (selected from ISO 10350)

| Property | Unit | Standard | Specimen type (dimensions in mm) | Test conditions and supplementary instructions |
|---|---|---|---|---|
| **Rheological properties** | | | | |
| Melt mass-flow rate | g/10 min | ISO 1133 | Moulding compound | Use one of the test temperatures and loads given in Table 4 of ISO 15526-1[a] |
| Melt volume-flow rate | $cm^3$/10 min | | | |
| **Mechanical properties** | | | | |
| Tensile modulus | MPa | ISO 527-1 ISO 527-2 | See ISO 3167 | Test speed 1 mm/min |
| Yield stress | MPa | | | Test speed 50 mm/min |
| Yield strain | % | | | |
| Nominal strain at break | % | | | |
| Stress at 50 % strain | MPa | | | |
| Stress at break | MPa | | | Test speed 5 mm/min. Only to be quoted if stress at 50 % strain cannot be obtained at 50 mm/min |
| Strain at break | % | | | |
| Flexural modulus | MPa | ISO 178 | 80 × 10 × 4 | Test speed 2 mm/min |
| Flexural strength | MPa | | | |
| Charpy impact strength | $kJ/m^2$ | ISO 179-1 | 80 × 10 × 4 | Method 1eU (edgewise impact) |
| Charpy notched impact strength | $kJ/m^2$ | | 80 × 10 × 4 V-notch, $r = 0,25$ | Method 1eA (edgewise impact) |
| **Thermal properties** | | | | |
| Melting temperature | °C | ISO 3146 | Moulding compound | Method C (DSC or DTA). Use 10 °C/min. |
| Glass transition temperature | °C | IEC 61006 | Moulding compound | Method A (DSC or DTA). Use 10 °C/min. |
| Temperature of deflection under load | °C | ISO 75-1 ISO 75-2 | 80 × 10 × 4 flatwise | 0,45 MPa and 1,8 MPa |
| Flammability | mm/min | IEC 60695-11-10 | 125 × 13 × 3 | Method A — linear burning rate of horizontal specimens |
| | s | | | Method B (vertical)<br>a) afterflame time<br>b) afterglow time |
| **Electrical properties** | | | | |
| Relative permittivity | — | IEC 60250 | ⩾ 80× ⩾ 80 × 1 | Frequency 100Hz and 1 MHz (compensate for electrode edge effect) |
| Dissipation factor | — | | | |
| Volume resistivity | Ω · m | IEC 60093 | | Voltage 100 V |
| Surface resistivity | Ω | | | |
| Electric strength | kV/mm | IEC 60243-1 | ⩾ 80× ⩾ 80 × 4 | Use 25 mm/75 mm coaxial-cylinder electrode configuration. Immerse in IEC 60296 transformer oil. Use short time (rapid rise) test. |
| Comparative tracking index | — | IEC 60112 | ⩾ 15× ⩾ 15 × 4 | Use solution A |
| **Other properties** | | | | |
| Water absorption | % | ISO 62 | Thickness ⩽ 1 | Saturation value in water at 23 °C |
| | | | | Saturation value at 23 °C and 50 % relative humidity |
| Density | $kg/m^3$ | ISO 1183 | 10 × 10 × 4 | Use part of centre of multipurpose specimen |

[a] The melt density of unfilled grades is about 1 000 $kg/min^3$ to 1 100 $kg/m^3$ (depending on composition and temperature).

**Table 3 — Additional properties and test conditions of particular utility to PK moulding and extrusion materials**

| Property | Unit | Standard | Specimen type (dimensions in mm) | Test conditions and supplementary instructions | |
|---|---|---|---|---|---|
| Moisture content | % | ISO 15512 | Moulding compound | | |
| Ash | % | ISO 3451-4 | Moulding compound | | |
| Multiaxial impact behaviour | N | ISO 6603-2 | 60 × 60 × 2 | Maximum force $F_M$ | Striker diameter 20 mm. Lubricate the striker. Clamp the specimen tightly enough to prevent any out-of-plane movement of its extremities. |
| | J | | | Puncture energy $W_P$ at 50 % decrease in force after the maximum | |
| Coefficient of linear thermal expansion | $°C^{-1}$ | ISO 11359-2 | Prepared from ISO 3167 | Longitudinal and transverse. Record the secant value over the temperature range 23 °C to 55 °C. | |
| Oxygen index at ambient temperature | | ISO 4589-2 | 80 × 10 × 4 | Procedure A — top surface ignition | |
| Flammability | mm/min | IEC 60695-11-10 | 125 × 13 × 1,6 or other thickness | Method A — linear burning rate of horizontal specimens | |
| | s | | | Method B (vertical)<br>a) afterflame time<br>b) afterglow time | |
| Electric strength | kV/mm | IEC 60243-1 | $\geqslant$ 60× $\geqslant$ 60 × 1 | Use 20 mm diameter spherical electrodes. Immerse in IEC 60296 transformer oil. Use a voltage application rate of 2 kV/s. | |
| | | | $\geqslant$ 60× $\geqslant$ 60 × 2 | | |

**ICS 83.080.20**
Price based on 5 pages