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Composites — Prepregs — Determination of gel time

Composites — Préimprégnés — Détermination du temps de gélification

Reference number
ISO 15040:1999(E)

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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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 15040 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 13, *Composites and reinforcement fibres*.

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Composites — Prepregs — Determination of gel time

1 Scope

This International Standard specifies a method for the determination of the gel time of prepregs made of continuous reinforcement impregnated with epoxy and/or unsaturated-polyester resin.

The method is applicable to most prepregs with a width in the range 300 mm to 1 000 mm.

It is not suitable for very narrow prepregs (for example narrow tape), nor for prepregs with a low resin content.

NOTE Other methods of measuring gel time exist. These methods are based on principles which differ from those described in clause 4, and the results obtained using such methods may be different from those obtained with this International Standard. The method described below is the traditionally used one and is widely accepted, even though it may be somewhat obsolete.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard 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 291:1997, *Plastics — Standard atmospheres for conditioning and testing.*

ISO 472:1999, *Plastics — Vocabulary.*

ISO 8604:1988, *Plastics — Prepregs — Definitions of terms and symbols for designations*.

3 Terms and definitions

For the purposes of this International Standard, the terms and definitions given in ISO 472 and ISO 8604 apply.

4 Principle

A test specimen is prepared by laying up square pieces cut from the prepreg sample and wrapped in an impervious film or foil. The resin is squeezed out by applying pressure to the specimen in a hot press preheated to the test temperature. The gel time of the resin is measured as the point at which it can no longer be spun or drawn into a thread.

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5 Apparatus

5.1 Cutting template, made of a hard metal such as steel, or ceramic material, measuring 50 mm by 50 mm and about 2,5 mm thick.

5.2 Knife, single-edge.

5.3 Notched plate for measuring gel time, as shown in Figure 1 for example. The plate shall be sufficiently flat to ensure a uniform temperature distribution.

5.4 Heated-platen press, capable of raising the temperature to 200 °C and maintaining the pressure at 300 kPa to 600 kPa over a 50 mm by 50 mm area. The platens shall be sufficiently flat to ensure a uniform temperature distribution.

5.5 Release film, heat-resistant, for example tetrafluoroethylene-hexafluoroethylene copolymer (FEP).

5.6 Stopwatch, capable of measuring seconds.

5.7 Pick, 2 mm to 3 mm in diameter and about 150 mm in length, made of heat-insulating material such as wood or bamboo.

5.8 Wrapping material: aluminium foil about 15 µm thick or polymer film which is chemically inert towards the prepreg resin and has a melting point higher than the anticipated test temperature, for example tetrafluoroethylene-hexafluoroethylene copolymer (FEP) or polyimide.

6 Preparation of test specimens

6.1 A minimum of three specimens shall be tested from each sample.

6.2 Using the cutting template (5.1), carefully cut out pieces 50 mm by 50 mm square in one or more rows across the width of the prepreg. Cut out sufficient pieces so that, when they are placed one on top of the other, they will give specimens about 2,5 mm thick. If the necessary number of pieces cannot be cut out across the width of the prepreg (as with narrow tape, for example), they may be cut out in the longitudinal direction. The edges and selvedges of the prepreg shall not be included in any of the pieces.

7 Conditioning and test atmosphere

7.1 Conditioning

Prepregs are usually stored at a low temperature, such as –18 °C. Allow a sealed package of prepregs to warm up to ambient temperature before taking the sample. Ensure that the prepregs do not absorb moisture from the atmosphere.

7.2 Test atmosphere

Prepare the specimens and carry out the test in a room in which the atmosphere is one of the standard atmospheres defined in ISO 291, unless otherwise specified. If the press is installed in an insufficiently conditioned atmosphere, the time during which the specimen is exposed to this atmosphere shall be kept as short as possible.

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8 Procedure and expression of results

8.1 Place the notched plate (5.3) on the lower platen of the press (5.4) and preheat to the cure temperature ± 3 °C. The test temperature shall be determined by agreement between the user and supplier of the prepreg.

8.2 Wrap each specimen in two sheets of wrapping material (5.8) so that one end remains open.

8.3 Place a wrapped specimen on the notched plate, with release film (5.5) between the specimen and each platen, as shown in Figure 2.

8.4 Immediately start the stopwatch (5.6) and simultaneously apply sufficient pressure to squeeze resin from the specimen.

8.5 Using the pick (5.7), examine the ability of the resin squeezed from the specimen to be drawn out into a filament or thread. Do this by inserting the end of the pick into the resin and drawing it out with a slight twisting motion. Take as the gel time the time at the end of which a thread of resin can no longer be drawn out with the pick (see Figure 3).

8.6 Repeat the procedure described in 8.1 to 8.5 for each of the other specimens (at least two more).

9 Precision

The precision of this method is not known because interlaboratory data are not available. When interlaboratory data are obtained, a precision statement will be added at the following revision.

10 Test report

The test report shall include the following infomation:

a) a reference to this International Standard;

b) all details necessary for complete identification of the sample;

c) the test conditions: test temperature, test pressure and number of square pieces laid up to produce the test specimen;

d) the gel time measured for each of the specimens tested, and the average value of all the results;

e) the date of the test.

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Dimensions in millimetres
Tolerance: ± 1 mm
Material: aluminium alloy or steel

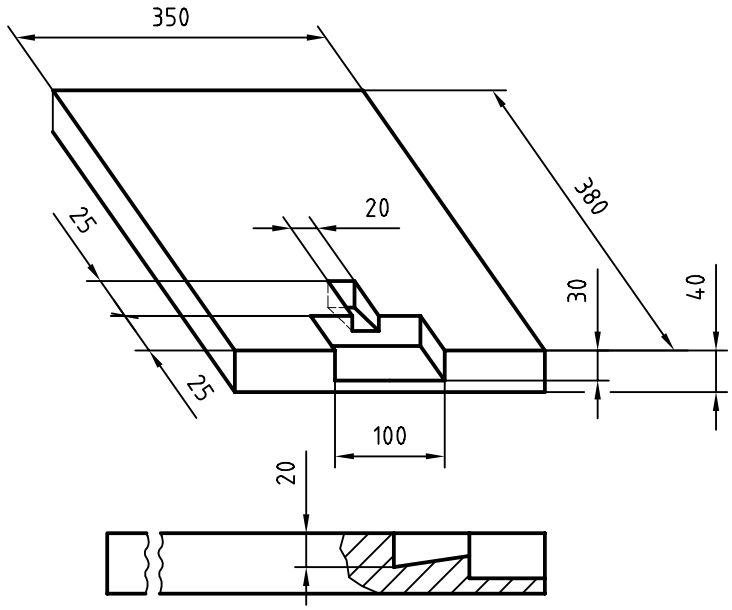

Figure 1 — Notched plate for measuring gel time

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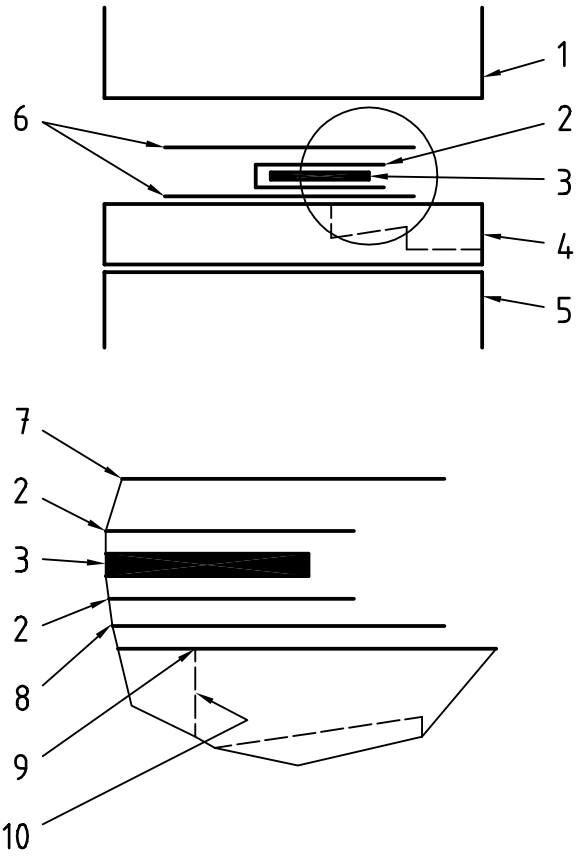

Key

1	Upper platen	6	Release film
2	Wrapping material	7	Upper sheet of release film
3	Test specimen	8	Lower sheet of release film
4	Notched plate	9	End of notch
5	Lower platen	10	Resin squeezed out of specimen will flow towards this wall

Figure 2 — Position of test specimen

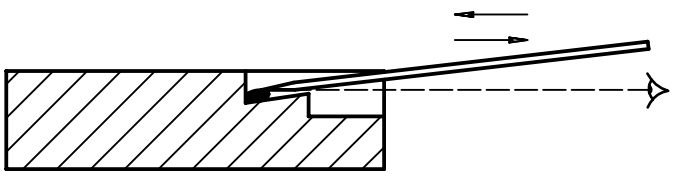

Figure 3 — Assessment of thread formation

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