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Composites — Prepregs — Determination of resin flow

Composites — Préimprégnés — Détermination de l'écoulement de résine

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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 15034 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 13, *Composites and reinforcement fibres*.

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Composites — Prepregs — Determination of resin flow

1 Scope

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

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*.

ISO 9782:1993, *Plastics — Reinforced moulding compounds and prepregs — Determination of apparent volatile-matter content*.

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 cut from a prepreg sample and placed between bleeder cloth and release film. This assembly is cured at the test temperature and pressure in a hot press. After curing, any resin which flowed beyond the original dimensions of the test specimen is removed. The resin flow is calculated as the percent difference between the mass of the test specimen before and after curing.

5 Apparatus

5.1 Cutting template, made of metal or ceramic material, measuring (100 ± 1) mm by (100 ± 1) mm and about 5 mm thick. Hard metals such as steel are recommended.

5.2 Knife, single-edge.

5.3 Analytical balance, capable of weighing to the nearest 1 mg.

5.4 Glass bleeder cloth, 181 style or equivalent.

5.5 Release film (perforated), heat-resistant, for example polytetrafluoroethylene, with suitable perforations through which the resin can flow out.

5.6 Release film (unperforated), heat-resistant, for example a copolymer of tetrafluoroethylene and hexafluoroethylene (FEP).

5.7 Heated platen press, capable of raising the temperature to 200 °C and maintaining the pressure at up to 600 kPa over a 100 mm by 100 mm area.

6 Preparation of test specimens

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

6.2 Using the template, carefully cut pieces measuring 100 mm by 100 mm from the prepreg sample. Cut the pieces out 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 0,2 mm to 0,5 mm thick. If the necessary number of pieces cannot be cut out in the width direction (as with narrow tape, for example), they may be cut out in the longitudinal direction. The edges and selvages of the prepreg shall not be included in any of the pieces.

6.3 In the case of unidirectional prepregs, lay up the plies with alternating plies perpendicular to each other. Using two or four plies for each specimen is recommended. If the recommended number of plies does not give a thickness in the required range, a different number of plies may be used, but this shall be noted in the test report.

7 Conditioning and test atmospheres

7.1 Conditioning

Prepregs are usually stored at a low temperature, such as –18 °C. Before opening a sealed package of prepregs, allow it to warm up to the point where no condensation takes place on the outside of the package. 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.

8 Procedure

8.1 Weigh a test specimen to the nearest 1 mg and record the mass as m_1 .

8.2 Cut out two pieces of perforated release film about 150 mm by 150 mm square.

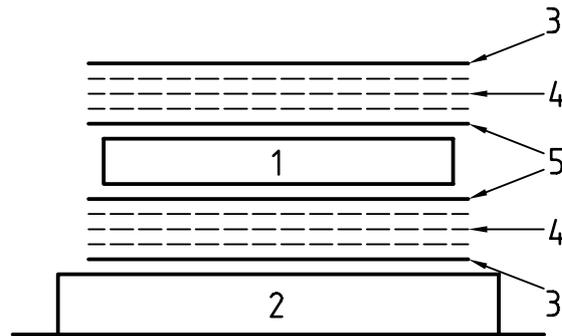
8.3 Cut out six pieces of bleeder cloth about 150 mm by 150 mm square.

8.4 Cut out two pieces of unperforated release film about 150 mm by 150 mm square.

8.5 Prepare the test specimen assembly as shown in Figure 1.

8.6 Insert the specimen assembly into the press preheated to the prescribed cure temperature ± 3 °C, and immediately apply a uniform pressure of 400 kPa to 600 kPa (the pressure shall rise to the specified value within 5 s of insertion of the assembly). Hold the pressure until the degree of cure is sufficient to allow the cured resin to be handled.

The cure conditions shall be determined by agreement between the user and supplier of the prepreg.

**Key**

- 1 Test specimen
- 2 Work surface
- 3 Unperforated release film
- 4 Glass bleeder cloth (three plies)
- 5 Perforated release film

- a) Place a piece of unperforated release film on the work surface.
- b) Lay three pieces of bleeder cloth on the release film as shown.
- c) Place a piece of perforated release film on the bleeder cloth as shown.
- d) Place the test specimen on the perforated release film, centered, and with its edges parallel to the edges of the release film.
- e) Cover the specimen with another piece of perforated release film, three pieces of bleeder cloth and a piece of unperforated release film. All edges shall be aligned with the other set of films and cloth.

Figure 1 — Test specimen assembly

8.7 Remove the test specimen assembly from the press and allow to cool. Separate the unperforated release film, bleeder cloth and perforated release film from the specimen. Remove any cured resin which flowed beyond the dimensions of the original uncured test specimen.

8.8 Reweigh the test specimen to the nearest 1 mg and record the mass as m_2 .

8.9 Repeat the procedure in 8.1 to 8.8 with the remaining specimens (giving a total of at least three results).

9 Expression of results

9.1 Calculate the resin flow F_{r1} , in percent, using the following equation:

$$F_{r1} = \frac{m_1 - m_2}{m_1} \times 100$$

where

m_1 is the mass, in grams, of the test specimen before curing;

m_2 is the mass, in grams, of the test specimen after curing.

9.2 For prepregs with volatile ingredients in the original composition, calculate the resin flow F_{r2} , in percent, using the following equation:

$$F_{r2} = \frac{m_1(1 - VC / 100) - m_2}{m_1(1 - VC / 100)} \times 100$$

where VC is the volatile-matter content, in percent, determined in accordance with ISO 9782.

10 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.

11 Test report

The test report shall include the following information:

- a) a reference to this International Standard;
- b) all details necessary for complete identification of the sample tested;
- c) the number of plies used to lay up the specimen;
- d) the cure conditions used, for example the cure temperature, pressure and time;
- e) the test result obtained for each of the three specimens, and the average value;
- f) in cases when F_{r2} is reported, the temperature at which the volatile-matter content was determined;
- g) the type of glass bleeder cloth used;
- h) the types of perforated and unperforated release film used;
- i) the date of the test.

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