INTERNATIONAL STANDARD

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Plastics — Epoxy resins —

Part 2: Preparation of test specimens and determination of properties

Plastiques — Résines époxydes —
Partie 2: Préparation des éprouvettes et détermination des propriétés

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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 part of ISO 3673 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 3673-2 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 12, *Thermosetting materials*.

ISO 3673 consists of the following parts, under the general title *Plastics — Epoxy resins*:

— *Part 1: Designation*

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

Introduction

The purpose of this part of ISO 3673 is to designate procedures for the determination of intrinsic properties of epoxy resins (EP). It specifies procedures and conditions for the preparation of test specimens of epoxy resins in a specified state, and methods for measuring their properties. Those properties and test methods which are suitable and necessary for characterizing epoxy resins are listed. Because of the specificity of thermosetting resins like epoxy resins, contrary to the other plastic products, a distinction is made between the presentation of the properties before crosslinking (characteristics which are useful for processing) and after crosslinking (intrinsic characteristics).

Plastics — Epoxy resins —

Part 2:
Preparation of test specimens and determination of properties

WARNING — Persons using this part of ISO 3673 should be familiar with normal laboratory practice. This part of ISO 3673 does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any national regulatory conditions.

1 Scope

This part of ISO 3673 specifies the methods of preparation of test specimens and the test methods to be used in determining the properties of epoxy resins. Requirements for handling test material and for conditioning both the test material before moulding and the specimens before testing are given here.

Properties of crosslinked epoxy resins have been selected from the general test methods in ISO 10350:1993. Other test methods in wide use, or of particular significance to epoxy resins, particularly properties useful for the processing of non-crosslinked epoxy resins, are also included in this part of ISO 3673.

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

Other standards exist concerning the determination of properties and preparation of test specimens for epoxy-based products, to which reference will be made, if required.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 3673. 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 3673 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*.

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

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

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

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

ISO 760:1978, *Determination of water — Karl Fischer method (General method).*

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

ISO 1523:1983, *Paints, varnishes, petroleum and related products — Determination of flashpoint — Closed cup equilibrium method.*

ISO 1675:1985, *Plastics — Liquid resins — Determination of density by the pyknometer method.*

ISO 2555:1989, *Plastics — Resins in the liquid state or as emulsions or dispersions — Determination of apparent viscosity by the Brookfield Test method.*

ISO 2592:—[2)], *Petroleum products — Determination of flash and fire points — Cleveland open cup method.*

ISO 2719:1988, *Petroleum products and lubricants — Determination of flash point — Pensky-Martens closed cup method.*

ISO 2811:1997 (all parts), *Paints and varnishes — Determination of density.*

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

ISO 3001:1999, *Plastics — Epoxy compounds — Determination of epoxy equivalent.*

ISO 3104:1994, *Petroleum products — Transparent and opaque liquids — Determination of kinematic viscosity and calculation of dynamic viscosity.*

ISO 3105:1994, *Glass capillary kinematic viscometers — Specifications and operating instructions*.

ISO 3146:—[3)], *Plastics — Determination of melting behaviour (melting temperature or melting range) of semi-crystalline polymers by capillary tube and polarizing-microscope methods.*

ISO 3219:1993, *Plastics — Polymers/resins in the liquid state or as emulsions or dispersions — Determination of viscosity using a rotational viscometer with defined shear rate.*

ISO 3521:1997, *Plastics — Unsaturated polyesters and epoxy resins — Determination of overall volume shrinkage.*

ISO 3679:1983, *Paints, varnishes, petroleum and related products — Determination of flashpoint — Rapid equilibrium method.*

ISO 4583:1998, *Plastics — Epoxy resins and related materials — Determination of easily saponifiable chlorine*.

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

ISO 4615:1979, *Plastics — Unsaturated polyesters and epoxide resins — Determination of total chlorine content.*

ISO 4625:1980, *Binders for paints and varnishes — Determination of softening point — Ring-and-ball method.*

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2) To be published. (Revision of ISO 2592:1973)

3) To be published. (Revision of ISO 3146:1985)

ISO 4630:1997, *Binders for paints and varnishes — Estimation of colour of clear liquids by the Gardner colour scale.*

ISO 4895:1997, *Plastics — Liquid epoxy resins — Determination of tendency to crystallize.*

ISO 6271:1997, *Clear liquids — Estimation of colour by the platinum-cobalt scale.*

ISO 7142:1982, *Binders for paints and varnishes — Epoxy resins — General methods of test.*

ISO 10350:1993[4)], *Plastics — Acquisition and presentation of comparable single-point data.*

ISO 11357-2:1999, *Plastics — Differential scanning calorimetry (DSC) — Part 2: Determination of glass transition temperature.*

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

ISO 11376:1997, *Plastics — Epoxy resins and glycidyl esters — Determination of inorganic chlorine.*

ISO 13651:1996, *Plastics — Epoxy resins and related materials — Determination of total saponifiable chlorine.*

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 60695-11-20:1999, *Fire hazard testing — Part 11-20: Test flames — 500 W flame test methods.*

ASTM D 1545-98, *Standard Test Method for Viscosity of Transparent Liquids by Bubble Time Method.*

3 Preparation of test specimens

3.1 General

This procedure is used only for the determination of crosslinked resin properties.

It is essential that specimens are always prepared by the same procedure using the same processing conditions. The specimens on which the properties are measured shall be cut from sheets of crosslinked resin, produced by a casting process. In view of the numerous possible fields of application for epoxy resins, the choice was made to prepare test specimens from resins not containing any filler or reinforcement in order to obtain the intrinsic properties of the crosslinked polymer, free of structural additives.

4) ISO 10350:1993 is the normative reference, although it has now been replaced by ISO 10350-1:1998.