SLOVENSKI PREDSTANDARD

OSIST prEN ISO 22088-1:2004

december 2004

Plastics - Determination of resistance to environmental stress cracking (ESC) - Part 1: General guidance (ISO/DIS 22088-1:2004)

ICS 83.080.01

Referenčna številka
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Plastics - Determination of resistance to environmental stress cracking (ESC) - Part 1: General guidance (ISO/DIS 22088-1:2004)

Plastiques - Détermination de la fissuration sous contrainte dans un environnement donné (ESC) - Partie 1: Directives générales (ISO/DIS 22088-1:2004)

This draft European Standard is submitted to CEN members for parallel enquiry. It has been drawn up by the Technical Committee CEN/TC 249.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

This draft European Standard was established by CEN in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Ref. No. prEN ISO 22088-1:2004: E

Foreword

This document (prEN ISO 22088-1:2004) has been prepared by Technical Committee ISO/TC 61 "Plastics" in collaboration with Technical Committee CEN/TC 249 "Plastics", the secretariat of which is held by IBN.

This document is currently submitted to the parallel Enquiry.

Endorsement notice

The text of ISO 22088-1:2004 has been approved by CEN as prEN ISO 22088-1:2004 without any modifications.

DRAFT INTERNATIONAL STANDARD ISO/DIS 22088-1

ISO/TC **61**/SC **6** Secretariat: **DIN**

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Plastics — Determination of resistance to environmental stress cracking (ESC) —

Part 1: General guidance

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ISO/CEN PARALLEL ENQUIRY

The CEN Secretary-General has advised the ISO Secretary-General that this ISO/DIS covers a subject of interest to European standardization. **In accordance with the ISO-lead mode of collaboration as defined in the Vienna Agreement, consultation on this ISO/DIS has the same effect for CEN members as would a CEN enquiry on a draft European Standard.** Should this draft be accepted, a final draft, established on the basis of comments received, will be submitted to a parallel two-month FDIS vote in ISO and formal vote in CEN.

In accordance with the provisions of Council Resolution 15/1993 this document is circulated in the English language only.

Conformément aux dispositions de la Résolution du Conseil 15/1993, ce document est distribué en version anglaise seulement.

To expedite distribution, this document is circulated as received from the committee secretariat. ISO Central Secretariat work of editing and text composition will be undertaken at publication stage.

Pour accélérer la distribution, le présent document est distribué tel qu'il est parvenu du secrétariat du comité. Le travail de rédaction et de composition de texte sera effectué au Secrétariat central de l'ISO au stade de publication.

Contents

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 2.

The main task of technical committees is to prepare International Standards. 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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 22088-1 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 6, *Ageing, chemical and environmental resistance*.

ISO 22088 consists of the following parts, under the general title *Plastics – Determination of resistance to environmental stress cracking (ESC)*:

— *Part 1: General guidance:*

— *Part 2: Constant tensile stress method* (replacement for ISO 6252)

— *Part 3: Bent strip method* (replacement for ISO 4599)

— *Part 4: Ball or pin impression method* (replacement for ISO 4600)

— *Part 5: Constant tensile deformation method* (new test method)

— *Part 6: Slow strain rate method* (new test method)

Plastics — Determination of resistance to environmental stress cracking (ESC) — Part 1: General guidance

Introduction

When a plastic material is stressed or strained in air below its yield point, stress cracking can occur after a period of time, which may be very long. These stresses may be internal or external, or a combination of both. Simultaneous exposure to a chemical environment with the same stress or strain may result in a dramatic shortening of the time to failure. This phenomenon is referred to as environmental stress cracking (ESC). ESC is exhibited by many materials, including plastics. The permissible long-term stress or strain may be reduced considerably by this phenomenon.

It is generally believed that ESC occurs via the following processes.

1. Formation of microvoids in specimens by microscopic stress concentration after applying stress.
2. Formation and subsequent growth of macrovoids caused by the breakdown of intermolecular bonds in intervoids that is produced by the action of a chemical environment, and formation of crazes which are composed of interconnected voids and fibrils.
3. Growth of the craze caused by the break-down of molecule in the fibrils, by applying stress and contacting with a chemical environment.
4. Finally, a crack starts at the tip of the craze, leading to brittle failure.

The produced cracks may penetrate completely through the thickness of the material, separating it into two or more pieces, or they may be arrested on reaching regions of lower stress or different material morphology.

The determination of ESC is complex because it is influenced by many parameters, including;

- test specimen dimensions;
- test specimen state (orientation, structure, internal stresses);
- specimen preparation
- heat history of specimen
- stress and strain;
- temperature of test;
- duration of test;
- chemical environment;
- test method;
- failure criterion.

By keeping all but one parameter constant, the influence of the variable parameter on ESC can be assessed. The main objective of ESC measurements is to determine the effect of chemical media (environment) on plastics (test specimens and articles).

The measurements may also be used to evaluate the influence of the moulding conditions upon the quality of an article when the failure mode corresponds to that obtained in actual service.

It is almost impossible, however, to establish any direct correlation between the results of short-duration ESC measurements on test specimens and the actual service behaviour of articles, because the behaviour of the latter is likely to be more complex than that of test specimens.

1 Scope

1.1 This part of ISO 22088 provides information and general guidance relevant to the selection of the testing method for ESC.

1.2 Part 2 describes a constant tensile stress method in which a test specimen is subjected to a constant tensile force, while immersed in a specified environment at the temperature selected for testing. The time and/or stress at which the specimen breaks are recorded.

1.3 Part 3 describes a bent strip method. In this test, strips of a plastic are positioned in a fixed flexural strain and exposed to a stress cracking agent for a predetermined period.

1.4 Part 4 describes a ball or pin impression method. In this test, a hole of specified diameter is drilled in the specimen. An oversized steel ball or pin is inserted into the hole and the test specimen is brought into contact with a test medium.

1.5 Part 5 describes a constant tensile deformation method. In this test, a specimen is fixed at a constant deformation while immersed in a specified test medium at a temperature selected for testing. The critical stress is obtained.

1.6 Part 6 describes the procedure for assessing the environment stress cracking susceptibility of polymeric materials in test mediums using the slow strain rate technique.

1.7 These methods are applicable to thermoplastic materials only.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

ISO 293:1986, *Plastics — Compression moulding test specimens of thermoplastics materials*

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

ISO 22088-2:-[1)], *Plastics — Determination of resistance to environmental stress cracking (ESC) – Part 2: Constant tensile stress method*

ISO 22088-3:-[2)] *Plastics — Determination of resistance to environmental stress cracking (ESC) – Part 3: Bent strip method*

ISO 22088-4:-[3)], *Plastics — Determination of resistance to environmental stress cracking (ESC) – Part 4: Ball or pin impression method*

ISO 22088-5:-[4)], *Plastics — Determination of resistance to environmental stress cracking (ESC) – Part 5: Constant tensile deformation method*

ISO 22088-6:-[5)], *Plastics — Determination of resistance to environmental stress cracking (ESC) – Part 6: Slow strain rate method*

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1), 2), 3), 4), 5) To be published.