INTERNATIONAL STANDARD

ISO 6252

Second edition
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Plastics — Determination of environmental stress cracking (ESC) — Constant-tensile-stress method

Plastiques — Détermination de la fissuration sous contrainte dans un environnement donné (ESC) — Méthode sous contrainte de traction constante

Reference number
ISO 6252:1992(E)

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.

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.

International Standard ISO 6252 was prepared by Technical Committee ISO/TC 61, *Plastics*, Sub-Committee SC 6, *Ageing, chemical and environmental resistance.*

This second edition cancels and replaces the first edition (ISO 6252:1981), which has been revised to include a third method (method C).

Annex A of this International Standard is for information only.

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Introduction

Environmental stress cracking is exhibited by many materials, including plastics. 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. Exposure to a chemical environment simultaneously 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). The permissible long-term stress or strain may be reduced considerably by this phenomenon.

The cracks produced 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);

— 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 may not be possible, 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.

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Plastics — Determination of environmental stress cracking (ESC) — Constant-tensile-stress method

1 Scope

This International Standard specifies methods for the determination of environmental stress cracking (ESC) of plastics when they are subjected to a constant tensile force in the presence of chemical agents.

It is applicable to test specimens prepared by moulding and/or machining and can be used both for the assessment of ESC of plastics materials exposed to different environments, and for the determination of ESC of different plastics materials exposed to a specific environment.

NOTE 1 Methods for the determination of environmental stress cracking by means of a constant-strain test are specified in ISO 4599 and ISO 4600.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 150:1980, *Raw, refined and boiled linseed oil for paints and varnishes — Specifications and methods of test.*

ISO 291:1977, *Plastics — Standard atmospheres for conditioning and testing.*

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

ISO 294:1975, *Plastics — Injection moulding test specimens of thermoplastic materials.*

ISO/R 527:1966, *Plastics — Determination of tensile properties.*

ISO 899:1981, *Plastics — Determination of tensile creep.*

ISO 2557-1:1989, *Plastics — Amorphous thermoplastics — Preparation of test specimens with a specified maximum reversion — Part 1: Bars.*

ISO 2818:1980, *Plastics — Preparation of test specimens by machining.*

ISO 3167:1983, *Plastics — Preparation and use of multipurpose test specimens.*

ISO 4599:1986, *Plastics — Determination of resistance to environmental stress cracking (ESC) — Bent strip method.*

ISO 4600:1992, *Plastics — Determination of environmental stress cracking (ESC) — Ball or pin impression method.*

3 Principle

A test specimen is subjected to a constant tensile force, corresponding to a stress lower than that at yield, while immersed in a specified environment at the temperature selected for testing. The time and/or stress at which the specimen breaks is recorded.

The environmental stress cracking of the test specimens is determined by one of the following methods (A, B or C), depending upon the time to rupture:

- Method A: Determination of the tensile stress leading to rupture at 100 h. This stress is obtained by interpolation of the graph of time to rupture versus applied tensile stress.
- Method B: Determination of the time to rupture under a specified tensile stress. This method is used when the time to rupture exceeds 100 h.