SLOVENSKI STANDARD
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Polimerni materiali – Napotki za uporabo standardnih preskusov z ognjem

Plastics -- Guidance for the use of standard fire tests

Plastiques -- Lignes directrices pour l'utilisation d'essais au feu normalisés

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13.220.40	Sposobnost vžiga in obnašanje materialov in proizvodov pri gorenju	Ignitability and burning behaviour of materials and products
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INTERNATIONAL STANDARD

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Plastics — Guidance for the use of standard fire tests

Plastiques — Lignes directrices pour l'utilisation d'essais au feu normalisés

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Contents

Page

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.

ISO 10840 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 4, *Burning behaviour*.

This first edition of ISO 10840 cancels and replaces ISO/TR 10840:1993, which has been technically revised.

Introduction

Many of the current reaction-to-fire tests were developed, prior to the widespread use of synthetic polymers, to assess products incorporating materials such as wood (in the building industry), paper (in electrical wires and cables), and naturally occurring fibres such as cotton, wool and horsehair (in many textile, furniture and electrical applications). The “reaction-to-fire” characteristics of these “traditional” or “older-generation” materials are often very different from those of synthetic materials, especially thermoplastics.

ISO/TC 61/SC 4 has, for a number of years, recognized the need for guidance for users of fire-test standards commonly applied to materials and products made of, or incorporating, plastics. During 1997, it decided to develop a guidance document in the form of an International Standard using ISO/TR 10840, and particularly its Annex A, as the basis.

Annex A of ISO/TR 10840:1993 listed a series of potential problems associated with the reaction-to-fire testing of plastics materials and products. However, it provided users of the test methods with no practical assistance on how to cope with the difficulties listed.

Plastics — Guidance for the use of standard fire tests

1 Scope

This International Standard covers the following aspects of fire testing:

— selection of appropriate test(s);

— listing of reaction-to-fire characteristics which the test(s) can measure;

— assessment of the test(s) for their suitability for material characterization, quality control, pre-selection and/or end-product testing;

— problems that can arise when plastics specimens are tested in standard fire tests.

Particular attention is given to the provision of guidance for inexperienced users who may need to assess the fire performance of materials or products made of, or incorporating, plastics. This International Standard also provides answers to frequently asked questions concerning standard fire tests; these cover factors such as cost, test duration, complexity, required operator skills, quality of the data produced, relevance to fire hazard assessment as well as test repeatability and reproducibility. Preparation of this International Standard has involved a review and assessment of the most frequently used fire tests applied to the materials and products within the scope of ISO/TC 61/SC 4.

The main focus in this International Standard is on reaction-to-fire testing. Fire-resistance testing has also been considered, however, in order to take account of the widespread use of advanced polymer composites and related materials with superior thermo-mechanical stability which may be used in applications where there is a demand for some degree of fire resistance. Further development of such plastics composites and related products will predictably increase the demand for fire-resistance testing.

The scope of this International Standard does not include the development or design of fire tests for plastics.

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 13943, *Fire Safety — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 13943 and the following apply.

3.1
test specimen
test piece that may be cut from a sample of a product, or prepared by moulding or otherwise, as specified by the test procedure, or a representative sample of the product itself

3.2
sample
representative part of a manufactured product or piece of material or semi-finished product

3.3
plastics end-product test
test made on a complete product, piece, part, component or sub-assembly

3.4
plastics pre-selection test
test made on a standardized shape, for example a rectangular bar prepared using standard moulding procedures

4 Fire scenarios

4.1 General

A number of fire parameters influence the development of a fire and, moreover, the fire parameters measured during the pre-flashover and the post-flashover stages differ greatly.

There are four main stages in the development of a fire within an enclosed space. These are assessed using measurements of temperature and time as shown in Figure 1.

4.2 Initiation and early growth

This stage includes the exposure of a product to a heat source, ignition and early development of a fire. Two types of combustion may exist at this stage, smouldering and flaming. Smouldering is a slow, flameless combustion producing very little heat, but having the potential to fill an enclosed space with smoke and toxic gases.

After ignition, the development of a flaming fire will depend on the following factors:

— fire growth on the item first ignited;

— fire spread to other items;

— the effect of intervention (portable extinguishers, sprinklers, fire brigades);

— the ventilation conditions.

4.3 Development of fire

As a fire develops, a hot smoke and gas layer usually builds up below the ceiling.

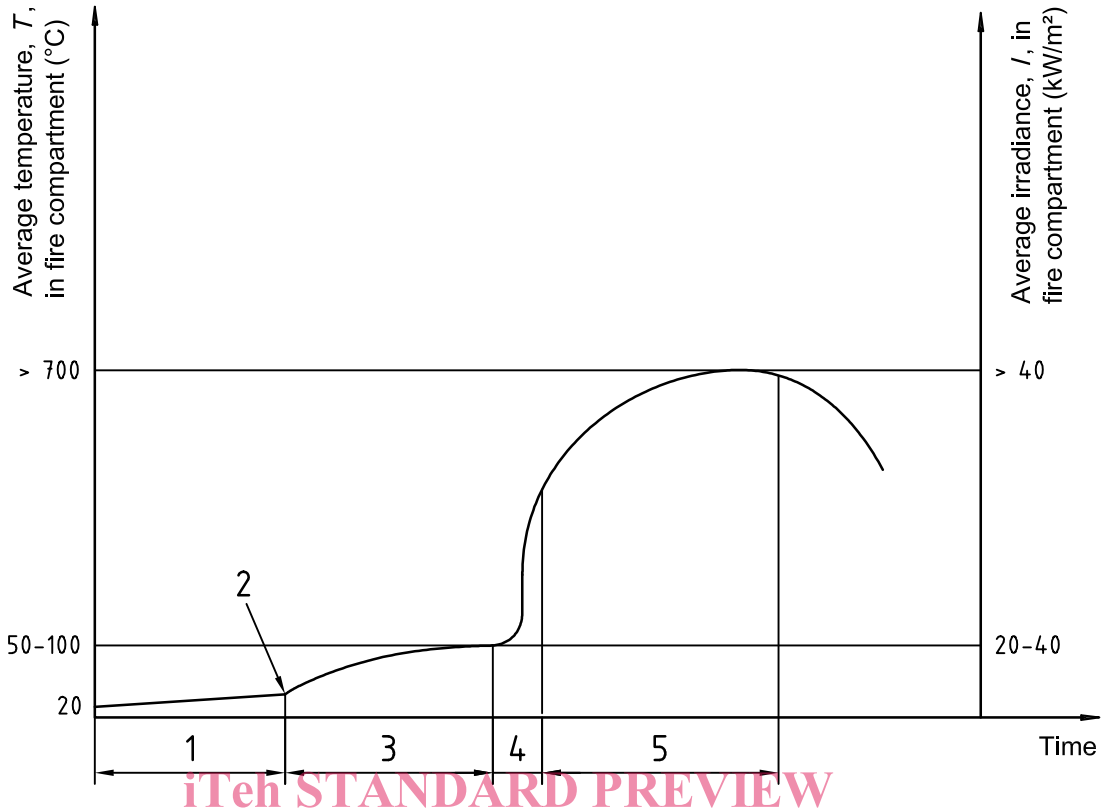
The radiant heat transfer to combustible items accelerates the thermal decomposition of material below the smoke layer, and the rate of fire spread increases.

Flashover is the sudden transition from a localized fire to the ignition of the gas layer and subsequently of all exposed flammable surfaces, and will lead to a fully developed fire. Flashover is uncommon in large enclosed spaces, as the temperature conditions required are not often reached.

Flashover usually occurs at temperatures around 600 °C; thereafter, the rate of heat release increases rapidly to reach a maximum value.

4.4 Fully developed fire

A fire is regarded as fully developed when all fuel within the enclosed space is burning. This stage usually follows flashover, but some fires may become fully developed without passing through the flashover phase.



Key

1 time to ignition

2 $T > 100$ °C, $I > 25$ kW/m^2 close to ignited item

3 developing fire

4 flashover

5 fully developed fire

Figure 1 — Typical course of a fire going to flashover in an enclosed space

4.5 Decay

The decay stage of a fire is reached when all the combustible material or available air has been consumed, or when the fire is suppressed. In the pre-flashover phase, reaction-to-fire characteristics of products are important, while in the post-flashover phase resistance-to-fire parameters of complete assemblies apply.

Fire building regulations make a distinction between these two conditions. Table 1 summarizes the important fire parameters associated with reaction to fire and resistance to fire.

Table 1 — Phases of a fire

Phase	Stage	Parameters
Pre-flashover	Initiation	Ignitability
	Developing fire	Fire growth (ignitability, flame spread, and heat, smoke and toxic-effluent release)
Post-flashover	Developed fire	Resistance to fire (load-bearing capability, integrity, insulating capability)