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Plastics — Determination of thermal conductivity and thermal diffusivity —

Part 2: Transient plane heat source (hot disc) method

Plastiques — Détermination de la conductivité thermique et de la diffusivité thermique —

Partie 2: Méthode de la source plane transitoire (disque chaud)

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 5, *Physical-chemical properties,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 249, *Plastics,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 22007-2:2015), which has been technically revised.

The main changes are as follows:

— Figure 2 has been corrected;

— the term "penetration depth" (former 3.1) has been deleted;

— several Notes have been changed to body text;

— reference has been made in the main text to the theory of sensitivity coefficients.

A list of all parts in the ISO 22007 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

A significant increase in the development and application of new and improved materials for broad ranges of physical, chemical, biological, and medical applications has necessitated better performance data from methods of measurement of thermal-transport properties. The introduction of alternative methods that are relatively simple, fast, and of good precision would be of great benefit to the scientific and engineering communities[1].

A number of measurement techniques described as transient methods have been developed of which several have been commercialized. These are being widely used and are suitable for testing many types of materials. In some cases, they can be used to measure several properties separately or simultaneously[2],[3].

A further advantage of some of these methods is that it has become possible to measure the true bulk properties of a material. This feature stems from the possibility of eliminating the influence of the thermal contact resistance (see 8.1.1) that is present at the interface between the probe and the specimen surfaces[1],[3],[4],[5],[6].

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Plastics — Determination of thermal conductivity and thermal diffusivity —

Part 2: Transient plane heat source (hot disc) method

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1 Scope

This document specifies a method for the determination of the thermal conductivity and thermal diffusivity, and hence the specific heat capacity per unit volume of plastics. The experimental arrangement can be designed to match different specimen sizes. Measurements can be made in gaseous and vacuum environments at a range of temperatures and pressures.

This method gives guidelines for testing homogeneous and isotropic materials, as well as anisotropic materials with a uniaxial structure. The homogeneity of the material extends throughout the specimen and no thermal barriers (except those next to the probe) are present within a range defined by the probing depth(s) (see 3.1).

The method is suitable for materials having values of thermal conductivity, λ, in the approximate range 0,010 $W \cdot m^{-1} \cdot K^{-1} < \lambda < 500\ W \cdot m^{-1} \cdot K^{-1}$, values of thermal diffusivity, α, in the range $5 \times 10^{-8}\ m^2 \cdot s^{-1} < \alpha < 10^{-4}\ m^2 \cdot s^{-1}$, and for temperatures, T, in the approximate range $50\ K < T < 1\ 000\ K$.

NOTE 1 The specific heat capacity per unit volume, C, $C = \rho \cdot c_p$, where ρ is the density and c_p is the specific heat per unit mass and at constant pressure, can be obtained by dividing the thermal conductivity, λ, by the thermal diffusivity, α, i.e. $C = \lambda/\alpha$, and is in the approximate range $0{,}005\ MJ \cdot m^{-3} \cdot K^{-1} < C < 5\ MJ \cdot m^{-3} \cdot K^{-1}$. It is also referred to as the volumetric heat capacity.

NOTE 2 If the intention is to determine the thermal resistance or the apparent thermal conductivity in the through-thickness direction of an inhomogeneous product (for instance a fabricated panel) or an inhomogeneous slab of a material, reference is made to ISO 8301, ISO 8302 and ISO 472.

The thermal-transport properties of liquids can also be determined, provided care is taken to minimize thermal convection.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 22007-1, *Plastics — Determination of thermal conductivity and thermal diffusivity — Part 1: General principles*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 22007-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

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