



BSI Standards Publication

Plastics – Determination of thermal conductivity and thermal diffusivity

Part 1: General principles (ISO 22007-1:2017)

National foreword

This British Standard is the UK implementation of EN ISO 22007-1:2017. It is identical to ISO 22007-1:2017. It supersedes BS EN ISO 22007-1:2012, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PRI/21, Testing of plastics.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2018
Published by BSI Standards Limited 2018

ISBN 978 0 580 91732 5

ICS 83.080.01

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 January 2018.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------

English Version

Plastics - Determination of thermal conductivity and
thermal diffusivity - Part 1: General principles (ISO
22007-1:2017)

Plastiques - Détermination de la conductivité
thermique et de la diffusivité thermique - Partie
1: Principes généraux (ISO 22007-1:2017)

Kunststoffe - Bestimmung der Wärmeleitfähigkeit
und der Temperaturleitfähigkeit - Teil 1:
Allgemeine Grundlagen (ISO 22007-1:2017)

This European Standard was approved by CEN on 3 August 2017.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists 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 CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

European foreword

This document (EN ISO 22007-1:2017) 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 NBN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2018, and conflicting national standards shall be withdrawn at the latest by May 2018.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 22007-1:2012.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

The text of ISO 22007-1:2017 has been approved by CEN as EN ISO 22007-1:2017 without any modification.

Contents

Page

Foreword	iv
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Principles	2
5 Test methods	4
5.1 General.....	4
5.2 Hot-wire method.....	5
5.3 Line-source method.....	6
5.4 Transient plane source method.....	7
5.5 Temperature wave analysis method.....	8
5.6 Laser flash method.....	8
5.7 Steady-state methods.....	9
5.7.1 Guarded hot-plate method.....	9
5.7.2 Guarded heat flow meter method and heat flow meter method.....	10
6 Test report	11
Annex A (informative) Sources of uncertainty on measuring thermal transport properties	12
Bibliography	17

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 on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 5, *Physical-chemical properties*.

This second edition cancels and replaces the first edition (ISO 22007-1:2009), which has been technically revised.

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

Plastics – Determination of thermal conductivity and thermal diffusivity —

Part 1: General principles (ISO 22007-1:2017)

SAFETY STATEMENT — Persons using this document should be familiar with normal laboratory practice, if applicable. This document does not purport to address all of the safety concerns, 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 regulatory requirements.

1 Scope

This document describes the background to methods for the determination of the thermal conductivity and thermal diffusivity of polymeric materials. Different techniques are available for these measurements and some may be better suited than others for a particular type, state and form of material. This document provides a broad overview of these techniques. Standards specific to these techniques, as referenced in this document, are used to carry out the actual test method.

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 472, *Plastics — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 472 and the following apply.

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

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

heat pulse

heat change in the form of a pulse produced by a heat source

3.2

heat pulse energy

amount of heat produced by a heat source within the heat pulse

Note 1 to entry: It is expressed in joules (J).

3.3

heat source

heater in the form of a wire, strip, plate or foil embedded within or attached to a test specimen or an area irradiated by incident light, e.g. a laser

3.4
heat flux

q
heat source output produced by a planar source per unit time and unit area

Note 1 to entry: It is expressed in watts per square metre (W/m²).

3.5
linear heat flow
heat source output produced by a linear source per unit time and unit length

Note 1 to entry: It is expressed in watts per metre (W/m).

3.6
penetration depth
characteristic depth used for describing the extent of heat penetration into the specimen during a transient measuring process

Note 1 to entry: It is expressed in metres (m).

3.7
temperature transient
temporary perturbation of temperature in a system initially at a uniform temperature due to a heat pulse for a period during which the system does not attain equilibrium

3.8
volumetric heat capacity
product of the density and the heat capacity

Note 1 to entry: It is expressed in joules per cubic metre kelvin [J/(m³ · K)].

3.9
thermal effusivity
 b
heat transport property given by the square root of the product of thermal conductivity and volumetric heat capacity:

$$b = \sqrt{\lambda \cdot \rho \cdot c_p} \quad (1)$$

where

λ is the thermal conductivity in watt per metre kelvin [W/(m · K)];

ρ is the density in kilogram per cubic metre [kg/m³];

c_p is the heat capacity in joule per kelvin kilogram [J/(K · kg)]

Note 1 to entry: It is expressed in joules per square metre kelvin square root second [J/(m² · K · s^{1/2})].

3.10
thermal resistivity
reciprocal of thermal conductivity

Note 1 to entry: It is expressed in metre kelvins per watt [(m · K)/W].

4 Principles

Thermal conductivity refers specifically to the mode of heat transfer via conduction. In thermal conductivity measurements, other modes of heat transfer, such as convection, radiation and mass transfer, may occur. Where these modes are significant, the measured property is usually referred