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Plastics - Determination of thermal conductivity and thermal diffusivity - Part 6: Comparative method for low thermal conductivities using a temperature-modulation technique (ISO 22007-6:2014)

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See Eesti standard EVS-EN ISO 22007-6:2015 sisaldab Euroopa standardi EN ISO 22007-6:2015 ingliskeelset teksti.	This Estonian standard EVS-EN ISO 22007-6:2015 consists of the English text of the European standard EN ISO 22007-6:2015.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 18.03.2015.	Date of Availability of the European standard is 18.03.2015.
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ICS 83.080.01

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 22007-6

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English Version

Plastics - Determination of thermal conductivity and thermal diffusivity - Part 6: Comparative method for low thermal conductivities using a temperature-modulation technique (ISO 22007-6:2014)

Plastiques - Détermination de la conductivité thermique et de la diffusivité thermique - Partie 6: Méthode comparative pour faibles conductivités thermiques utilisant une technique de modulation de la température (ISO 22007-6:2014)

Kunststoffe - Bestimmung der Wärmeleitfähigkeit und der Temperaturleitfähigkeit - Teil 6: Vergleichsmethoden für geringe Wärmeleitfähigkeit unter Anwendung einer Temperaturanpassungsmethode (ISO 22007-6:2014)

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Foreword

The text of ISO 22007-6:2014 has been prepared by Technical Committee ISO/TC 61 “Plastics” of the International Organization for Standardization (ISO) and has been taken over as EN ISO 22007-6:2015 by 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of an identical text or by endorsement, at the latest by September 2015, and conflicting national standards shall be withdrawn at the latest by September 2015

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Endorsement notice

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Introduction

Thermal insulating properties have become more important in view of power-saving technology. The method which is applicable to measure the lower thermal conductivity in smaller scale with a small amount of a specimen, such as a tray for food, a thermal printing film, a gelled sheet for the electric parts inside laptop PC, an adhesive paste, etc., is required for the micro-scale thermal design of plastics. A double-sensor system of high-sensitivity thermopile located in the different distances in the modulated temperature field, which is controlled by the Peltier thermo-module, is proposed for the determination of thermal conductivity of plastics. A decay parameter is utilized to determine the thermal conductivity of the sample. This method is applied to the measurement of low thermal conductivity in the range below 1,0 W/mK.

In contrast to a pulse or a transient method, high sensitivity and high-temperature resolution are characteristic of temperature modulated technique, in which employment of a lock-in amplifier reduces any influence of noise and interference.

The thermal conductivity of materials that are poor conductors of heat is usually determined by measuring the larger temperature gradients in the sample produced by a steady flow of heat in one-dimensional geometry. In order to reduce the errors of radiation and convection, it often requires large, precisely shaped samples and extreme care to be used successfully.

This part of ISO 22007 specifies a modulated temperature method to determine the thermal conductivity with a small temperature variation, minimizing the influence of radiation and convection.

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Plastics — Determination of thermal conductivity and thermal diffusivity —

Part 6: Comparative method for low thermal conductivities using a temperature-modulation technique

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1 Scope

This part of ISO 22007 specifies a modulated temperature method realizing the measurement of thermal conductivity. An input of temperature deviation is less than 1 K, and a double lock-in method is applied to amplify the small temperature modulation.

ISO 22007-3 specifies one of the modulated temperature methods where the phase shift is measured in the thermally thick condition, $kd >> 1$ [$k = (\omega/2\alpha)^{1/2}$, ω: angular frequency of temperature wave, α: thermal diffusivity, and d: thickness of the specimen]. In this condition, the backing material does not affect on the phase shift results on the sensor, on which temperature wave decays exponentially.

On the other hand, if $kd << 1$, the decay of temperature modulation is influenced by the backing materials. Based on this principle, this part of ISO 22007 specifies the method to determine the thermal conductivity of the sample (as a backing material), comparing the decay of temperature wave detected on both surfaces of the probe material.

Thermal conductivity is determined from the correlation between the thermal impedance and the decay ratio of amplitude using two reference materials measured at the same frequency and temperature.

The covering thermal conductivity range is adjusted with the reference materials and the probe materials. Basically, thermal conductivity is determined in the range from 0,026 W/mK to 0,6 W/mK.

In the case applying the method to inhomogeneous materials, cares must be taken to choose the appropriate measurement conditions in accordance with the thermal penetration depth.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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*

ISO 22007-1, *Plastics — Determination of thermal conductivity and thermal diffusivity — Part 1: General principles*

ISO 22007-3, *Plastics — Determination of thermal conductivity and thermal diffusivity — Part 3: Temperature wave analysis method*

ISO/TR 22007-5, *Plastics — Determination of thermal conductivity and thermal diffusivity — Part 5: Results of interlaboratory testing of poly(methyl methacrylate) samples*

ISO 80000-5, *Quantities and units — Part 5: Thermodynamics*

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