SLOVENSKI STANDARD
oSIST prEN ISO 11357-6:2024

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Polimerni materiali - Diferenčna dinamična kalorimetrija (DSC) - 6. del: Ugotavljanje časa indukcijske oksidacije (izotermični OIT) in temperature indukcijske oksidacije (izodinamični OIT) (ISO/DIS 11357-6:2024)

Plastics - Differential scanning calorimetry (DSC) - Part 6: Determination of oxidation induction time (isothermal OIT) and oxidation induction temperature (dynamic OIT) (ISO/DIS 11357-6:2024)

Kunststoffe - Dynamische Differenzkalorimetrie (DSC) - Teil 6: Bestimmung der Oxidations-Induktionszeit (isothermische OIT) und Oxidations-Induktionstemperatur (dynamische OIT) (ISO/DIS 11357-6:2024)

Plastiques - Analyse calorimétrique différentielle (DSC) - Partie 6: Détermination du temps d'induction à l'oxydation (OIT isotherme) et de la température d'induction à l'oxydation (OIT dynamique) (ISO/DIS 11357-6:2024)

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ISO/DIS 11357-6

Plastics — Differential scanning calorimetry (DSC) —

Part 6: Determination of oxidation induction time (isothermal OIT) and oxidation induction temperature (dynamic OIT)

Plastiques — Analyse calorimétrique différentielle (DSC) —

Partie 6: Détermination du temps d'induction à l'oxydation (OIT isotherme) et de la température d'induction à l'oxydation (OIT dynamique)

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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).

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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*.

This fourth edition cancels and replaces the third edition (ISO 11357-6:2018), which has been technically revised. The main changes compared to the previous edition are as follows:

— The isothermal stepwise temperature calibration has been added for isothermal OIT.

A list of all parts in the ISO 11357 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.

Introduction

The measurement of oxidation induction time or temperature described in this document provides a tool to assess the conformity of the material tested to a given formulation of plastics compounds, but it is not intended to provide the concentration of antioxidant. Different antioxidants can have different oxidation induction times or temperatures. Due to interaction of the antioxidant with other substances in the formulation, different oxidation induction times or temperatures can result even with products having the same type and concentration of antioxidant.

Plastics — Differential scanning calorimetry (DSC) —

Part 6: Determination of oxidation induction time (isothermal OIT) and oxidation induction temperature (dynamic OIT)

1 Scope

This document specifies methods for the determination of oxidation induction time (isothermal OIT) and oxidation induction temperature (dynamic OIT) of polymeric materials by means of differential scanning calorimetry (DSC). It is applicable to polyolefin resins that are in a fully stabilized or compounded form, either as raw materials or finished products. It can be applicable to other plastics.

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 293, *Plastics — Compression moulding of test specimens of thermoplastic materials*

ISO 294-3, *Plastics — Injection moulding of test specimens of thermoplastic materials — Part 3: Small plates*

ISO 472, *Plastics — Vocabulary*

ISO 11357-1, *Plastics — Differential scanning calorimetry (DSC) — Part 1: General principles*

ISO 17855-2, *Plastics — Polyethylene (PE) moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties*

ISO 19069-2, *Plastics — Polypropylene (PP) moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties*

ISO 21302-2, *Plastics — Polybutene-1 (PB-1) moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 472 and ISO 11357-1 and the following apply.

ISO and IEC maintain terminology 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/

3.1
oxidation induction time
isothermal OIT
relative measure of a stabilized material's resistance to oxidative decomposition, determined by the calorimetric measurement of the time interval to the onset of exothermic oxidation of the material at a specified temperature in an oxygen or air atmosphere, under atmospheric pressure

Note 1 to entry: It is expressed in minutes (min).

3.2
oxidation induction temperature
dynamic OIT
relative measure of a stabilized material's resistance to oxidative decomposition, determined by the calorimetric measurement of the temperature of the onset of exothermic oxidation of the material when subjected to a specified heating rate in an oxygen or air atmosphere, under atmospheric pressure

Note 1 to entry: It is expressed in degrees Celsius (°C).

Note 2 to entry: The oxidation induction temperature is also called oxidation onset temperature (OOT).

4 Principle

4.1 General

The time for which, or the temperature up to which, an antioxidant stabilizer system present in a test specimen inhibits oxidation is measured while the specimen is held isothermally at a specified temperature or heated at a constant rate in an oxygen or air atmosphere. The oxidation induction time or temperature is an assessment of the level (or degree) of stabilization of the material tested. Higher test temperatures will result in shorter oxidation induction times; faster heating rates will result in higher oxidation induction temperatures. The oxidation induction time and temperature are also dependent on the surface area of the specimen available for oxidation. It should be noted that tests carried out in pure oxygen will result in a lower oxidation induction time or temperature than tests performed under normal atmospheric-air conditions.

NOTE The oxidation induction time or temperature can be indicative of the effective antioxidant level present in the test specimen. Caution should be exercised in data interpretation, however, since oxidation reaction kinetics are a function of temperature and the inherent properties of the additives contained in the sample. For example, oxidation induction time or temperature results are often used to select optimum resin formulations. Volatile antioxidants or differences in activation energies of oxidation reactions can generate poor oxidation induction time or temperature results, even though the antioxidants can perform adequately at the intended temperature of use of the finished product.

4.2 Oxidation induction time (isothermal OIT)

The specimen and a reference material are heated at a constant rate in an inert gaseous environment (a flow of nitrogen). When the specified temperature has been reached, the atmosphere is changed to oxygen or air maintained at the same flow rate. The specimen is then held at constant temperature until the oxidative reaction is displayed on the thermal curve. The isothermal OIT is the time interval between the initiation of oxygen or air flow and the onset of the oxidative reaction. The onset of oxidation is indicated by an abrupt increase in the specimen's evolved heat and may be observed by a differential scanning calorimeter (DSC). The isothermal OIT is determined in accordance with 9.6.1.

4.3 Oxidation induction temperature (dynamic OIT)

The specimen and a reference material are heated at a constant rate in an oxygen or air atmosphere until the oxidative reaction is displayed on the thermal curve. The dynamic OIT is the temperature of the onset of the oxidative reaction. The onset of oxidation is indicated by an abrupt increase in the specimen's evolved heat and may be observed by a differential scanning calorimeter (DSC). The dynamic OIT is determined in accordance with 9.6.2.