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Plastics film and sheeting — Determination of gas-transmission rate —

Part 2: Equal-pressure method

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Contents

Page

Foreword ..... **iv**

1 Scope **1**

2 Normative references **1**

3 Terms and definitions **1**

4 Principle **2**

5 Test specimens **2**

6 Conditioning and test temperature **2**
6.1 Conditioning 2
6.2 Test temperature 2

7 Apparatus and materials **3**
7.1 General 3
7.2 Test gas 3
7.3 Transmission cell 3
7.4 Detection and measurement 3

8 Diffusion conditions **4**

9 Procedure **4**

10 Expression of results **5**

11 Precision **5**

12 Test report **5**

Annex A (normative) **Method for the determination of the oxygen-transmission rate using a coulometric sensor** **6**

Annex B (normative) **Detection by gas chromatography** **11**

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Foreword

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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 document 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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This document was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 11, *Products*.

This second edition cancels and replaces the first edition (ISO 15105-2:2003), which has been technically revised.

The main changes are as follows:

— The title has been changed to conform with the ISO/IEC Directives Part 2;

— Formula (B.1) has been corrected;

— general temperature and pressure for converting gas from moles to volume have been added to the note in Formulae (A.2) and (B.2);

— temperature and pressure used for converting gas from moles to volume have been added in the test report.

A list of all parts in the ISO 15105 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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Plastics film and sheeting — Determination of gas-transmission rate —

Part 2: Equal-pressure method

1 Scope

This document specifies a method for the determination of the gas-transmission rate of any plastic material in the form of film, sheeting, laminate, co-extruded material or flexible plastic-coated material.

Specific examples, currently in use, of the method are described in the annexes.

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 4593, *Plastics — Film and sheeting — Determination of thickness by mechanical scanning*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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
gas-transmission rate
GTR
J_{GTR}
amount of gas passing through a plastic material, per unit area and unit time, under unit partial-pressure difference between the two sides of the material

Note 1 to entry: When the gas used is oxygen, the value obtained is the oxygen-transmission rate (J_{O2GTR}).

3.2
gas permeability
coefficient of gas permeability
P
amount of gas passing through a homogeneous polymer material of unit thickness, per unit area and unit time, under unit partial-pressure difference between the two sides of the material

Note 1 to entry: The theoretical value of P is given by the Formula (1):

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$$P = J_{GTR} \times d \quad (1)$$

where

P is expressed in mole metres per square metre second pascal [mol·m/(m^2·s·Pa)];

J_{GTR} is expressed in moles per square metre second pascal [mol/(m^2·s·Pa)];

d is the average thickness of the specimen, expressed in metres.

Note 2 to entry: Although P is a physical property of a polymeric material, differences in film preparation affecting polymer orientation and crystal structure will have an effect on the permeation properties.

4 Principle

For methods using coulometric sensor (see Annex A) and gas chromatography (see Annex B), a test specimen is mounted in a gas-transmission cell (see Figures A.1 and B.1) to form a sealed barrier between two chambers. One chamber is slowly swept with a carrier gas. The second chamber is fed with the test gas. The total pressure is identical (atmospheric) in each chamber but, since the partial pressure of the test gas is higher in the second chamber, the test gas permeates through the barrier into the carrier gas in the first chamber.

The test gas which permeates through the specimen is carried by the carrier gas to a sensor the nature of which will depend on the material under test and the test gas used.

5 Test specimens

5.1 Test specimens shall be representative of the material under investigation, free from shrivelling, folds and pinholes, and of uniform thickness. They shall be larger than the gas-transmission area of the measurement cell and be capable of being mounted airtight.

5.2 Use three specimens unless otherwise specified or agreed upon among the interested parties.

5.3 Mark the side of the material facing the permeating gas.

In principle, the test should replicate the actual conditions of use, with the permeating gas passing from the inside to the outside of, for example, packaging material, or vice versa.

5.4 Measure the thickness of each specimen in accordance with ISO 4593, at at least five points distributed over the entire test area, and record the minimum, maximum and average values.

6 Conditioning and test temperature

6.1 Conditioning

The specimens shall be:

— either dried for not less than 48 h at the same temperature as that at which the test is to be carried out, using calcium chloride or another suitable drying agent in a desiccator;

— or conditioned at the temperature and humidity specified for the test for a length of time appropriate to the nature of the material under test.

6.2 Test temperature

Carry out the test in a room kept at 23 °C ± 2 °C, unless otherwise specified.

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