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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 1038.1-2022

**Plastics - Film and sheeting - Determination of
gas-transmission rate - Part 1: Differential-pressure methods**

塑料制品 薄膜和薄片 气体透过性试验方法 第1部分：差压法

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Foreword

This document was issued on 12 October 2022 by the State Administration for Market Regulation; Standardization Administration of the PRC and takes effect on 1 May 2023.

It is a GB/T standard: recommended rather than compulsory, but it is the text a Chinese reviewer applies when assessing a submission.

1 Scope

GB/T 1038.1-2022 covers the differential-pressure route to measuring how much gas passes through plastic film, sheeting and sandwich materials, and it holds two methods rather than one: the pressure sensor method and gas chromatography, each written out in a normative appendix. The principle is shared. The specimen is clamped so that it divides the permeation chamber into two independent halves, the low-pressure side is evacuated and then the high-pressure side, test gas is admitted to the high-pressure chamber, and what arrives on the other side is measured. The specimen clause rules out the things that quietly ruin a result: uneven thickness, wrinkles, folds, pinholes, and a specimen too small to be clamped tight across the permeation area. Shorter clauses then fix how results are expressed, the precision to expect, and what the test report has to carry. Gas transmission rate is what a barrier film is bought for, and it stands behind the shelf life printed on a food or a drug package; when a supplier and a customer measure the same roll and disagree,

the argument is almost always about method and specimen handling, which is why both are pinned down here. For film and laminate producers, packaging developers and testing laboratories.

This document specifies two test methods for the gas transmission of plastic film and sheeting,

as well as sandwich material under the condition of differential pressure---pressure sensor method and gas chromatography.

This document is applicable to the determination of gas transmission of plastic film and sheeting. The determination of gas transmission of other materials may take this as a reference.

NOTE: the differential-pressure method is also commonly referred to as the pressure differential method.

2 Normative References

The contents of the following documents constitute indispensable clauses of this document through the normative references in this text. In terms of references with a specified date, only

versions with a specified date are applicable to this document. In terms of references without a

specified date, the latest version (including all the modifications) is applicable to this document.

GB/T 6672 Plastics Film and Sheeting - Determination of Thickness by Mechanical Scanning

(GB/T 6672-2001, ISO 4593:1993, IDT)

3 Terms and Definitions

The following terms and definitions are applicable to this document.

3.1 Gas Transmission Rate; GTR

Gas transmission rate refers to the amount of gas permeating through a unit area of the material

per unit time under the unit pressure difference on both sides of the plastic material.

NOTE: when it is expressed by the amount of substance, the unit is [mol/(m² · s · Pa)];

when it is

expressed by volume, the unit is $[\text{cm}^3/(\text{m}^2 \cdot \text{d} \cdot \text{Pa})]$.

3.2 Gas Permeability; Coefficient of Gas Permeability

Gas permeability / coefficient of gas permeability refers to the amount of gas permeated per

unit area and unit thickness of the material per unit time under the unit pressure difference on

both sides of the plastic material.

NOTE 1: when it is expressed by the amount of substance, the unit is $[\text{mol} \cdot \text{m}/(\text{m}^2 \cdot \text{s} \cdot \text{Pa})]$; when

it is expressed by volume, the unit is $[\text{cm}^3 \cdot \text{cm}/(\text{cm}^2 \cdot \text{s} \cdot \text{Pa})]$.

NOTE 2: although P is a physical property of the polymer, the film preparation method affects the

orientation and crystal structure of the polymer material, which in turn affects the permeability of the material.

NOTE 3: P is only used to measure single-layer plastic film and sheeting made of a single material.

4 Principle

The specimen clamped in the permeation chamber (see Figure A.1 and Figure B.1) divides the

permeation chamber into two mutually independent parts. Vacuumize the low-pressure chamber,

then, vacuumize the high-pressure chamber. Fill the test gas into the high-pressure chamber

after vacuuming, and the test gas permeates into the low-pressure chamber through the specimen. By monitoring the pressure increase of the low-pressure chamber or through the gas

chromatograph, obtain the gas permeability of the specimen.

5 Specimen

5.1 The specimen shall be representative, uniform in thickness, and free of defects like wrinkles,

folds and pinholes, etc. The area of the specimen shall be larger than the gas permeation area

of the permeation chamber, and shall be tightly clamped on the permeation chamber.

5.2 Unless it is otherwise specified or agreed upon by the relevant parties, three specimens shall

be tested.

5.3 Mark the surface of the specimen facing the test gas.

NOTE: in principle, it is recommended that the test shall be exactly the same as the actual use

conditions, for example, for packaging materials, the gas permeates from the inside to the outside, or from the outside to the inside.

5.4 In accordance with GB/T 6672, measure the thickness of each specimen, expressed in (mm).

On the entire test area, measure no less than 5 points; record the minimum, maximum and average values, and the results are accurate to 1 mm.

6 Instruments, Test Procedures and Result Calculation

Two test methods for gas transmission rate are described in the appendixes of this document:

---Appendix A: pressure sensor method;

Appendix A

(normative)

Pressure Sensor Method

A.1 Overview

This method can be used to determine the gas transmission rate of various types of plastic material.

A.2 Instruments and Materials

A.2.1 Overview

See Figure A.1 for the schematic diagram of an instrument using pressure sensor for the determination of gas transmission rate. This instrument consists of permeation chamber,