NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

GB/T 1038.2-2022

Plastics - Film and sheeting - Determination of gas-transmission rate - Part 2: Equal-pressure methods

Issued on: October 12, 2022 **Implemented on: May 1, 2023**

Issued by: SAMR; SAC

Table of Contents

1 Scope

This document specifies two test methods for the gas transmission of plastic film and sheeting, co-extrusion material, plastic coating material and laminated board under the condition of equal pressure---coulomb 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.

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 partial pressure difference on both sides of the plastic material.

NOTE 1: when the test gas is oxygen, the test result is oxygen transmission rate (O2GTR).

NOTE 2: 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 [cm3/(m2 ? d ? 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 partial pressure difference on both sides of the plastic material.

NOTE 1: when it is expressed by the amount of substance, the unit is [mol ? m/(m2 ? s ? Pa)]; when it is expressed by volume, the unit is [cm3 ? cm/(cm2 ? s ? 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 (Chamber A and Chamber B). The test gas is introduced into Chamber A, while the carrier gas is introduced into Chamber B for slow purge. The total pressure in each chamber is equal (ambient atmospheric pressure). Due to the relatively high partial pressure of the test gas in Chamber A, the test gas permeates through the specimen into Chamber B, and is carried to the sensor by the carrier gas.

The type of sensor used depends on the specimen material and the test gas.

5.1 The specimen shall be representative, free of defects like wrinkles, folds and

pinholes, and

uniform in thickness. 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 (?m).

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 ?m.

6.1 Conditioning

The specimen shall:

---be placed in a desiccator filled with anhydrous calcium chloride or other desiccant for conditioning for no less than 48 h; alternatively, ---under the test conditions required by the product standard, perform the conditioning; in accordance with the characteristics of the material to be tested, adjust the conditioning time.

6.2 Test temperature

Unless it is otherwise specified, the test shall be carried out at 23 ?C ? 2 ?C.

7.1 Overview

See Figure A.1 and Figure B.1 for the schematic diagram of an instrument for the determination of gas transmission rate.

The instrument consists of permeation chamber, sensor, gas regulator and flow meter. In the permeation chamber, the test gas permeates through the specimen, and the sensor measures the amount of test gas permeated through the specimen. The flow meter is used to measure the flow rate of the test gas and the carrier gas.

7.2 Test Gas

The test gas is single gas or mixed gas.

Under the first circumstance, the gas pressure shall be atmospheric pressure.

Under the second circumstance, the gas pressure shall be the atmospheric pressure, and the partial pressure of each component depends on its concentration in the mixed gas.

7.3.1 The permeation chamber is divided into two mutually independent chambers - Chamber

A and Chamber B by the specimen to facilitate the permeation of the test gas (see 1 in Figure A.1 and 1 in Figure B.1).

7.3.2 The test gas is introduced into Chamber A under the specified conditions, and exits

Chamber A through an outlet of suitable size at the ambient atmospheric pressure.

7.3.3 The carrier gas is introduced into Chamber B under the specified conditions. The pressure

difference between the two chambers shall be as small as possible, so as to avoid deformation of the specimen.

7.3.4 The permeation chamber shall be shaped so that both sides of the specimen are purged in

a laminar flow.

9 Test Procedures

9.1 Remove the specimen to be tested from the state conditioning environment.

9.2 Load the specimen into the permeation chamber.

9.3 Inspect the specimen for visible defects, for example, wrinkles generated during loading.

9.4 Connect the permeation chamber to the sensor.

9.5 Adjust the two valves of the upstream of the permeation chamber to allow the carrier gas to flow into Chamber A and Chamber B. The gas flow rate is generally set between 5 mL/min ~ 100 mL/min.

9.6 Check the leakage of the instrument, then, thoroughly purge the instrument, considering that the specimen may have gas desorption. Continue to purge the instrument, until the signal received by the sensor is stable.

9.7 Once a stable signal is obtained, record this value as zero point.