

SEMI D80-0421

TEST METHOD FOR MEASUREMENT OF WATER VAPOR TRANSMISSION RATE FOR HIGH GAS BARRIER PLASTIC FILM IN A SHORT TIME

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NOTICE: Paragraphs entitled ‘NOTE:’ are not an official part of this Standard or Safety Guideline and are not intended to modify or supersede the official Standard or Safety Guideline. These have been supplied by the global technical committee to enhance the usage of the Standard or Safety Guideline.

1 Purpose

1.1 High gas barrier property is required to plastic films for electronic devices such as flexible displays. The purpose of this Standard is regulation for determining the water vapor transmission rate of plastic film using a quadrupole mass spectrometer as detector.

2 Scope

2.1 Determination of water vapor barrier property of plastic films with high gas barrier used for electronics devices such as flexible displays.

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3 Limitations

3.1 Test methods are adapted for plastic films with high gas barrier which water vapor transmission rate is lower than 10^{-3} g/(m²·24h).

4 Referenced Standards and Documents

4.1 ISO Standards¹

ISO/TS 20175 — Vacuum Technology – Vacuum Gauges – Characterization of Quadrupole Mass Spectrometers for Partial Pressure Measurement

NOTICE: Unless otherwise indicated, all documents cited shall be the latest published versions.

5 Terminology

5.1 Abbreviations and Acronyms

5.1.1 *QMS* — quadrupole mass spectrometer

5.1.2 *RP* — rotary pump

5.1.3 *TMP* — turbomolecular pump

5.2 Definitions

5.2.1 *dry chamber* — a part of the transmission cell. The transmission cell is divided by the sample, and dry chamber is placed on the detector side.

¹ International Organization for Standardization, ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland; Telephone: +41.22.749.01.11, <http://www.iso.org>

5.2.2 *quadrupole mass spectrometer (QMS)* — one type of mass analyzer used in mass spectrometry. It consists of four cylindrical rods, set parallel to each other. Ions are separated in a quadrupole based on the stability of their trajectories in the oscillating electric fields that are applied to the rods.

5.2.3 *rotary pump (RP)* — a type of vacuum pump used back pump for TMP.

5.2.5 *steady-state* — a state in which the water vapor transmission rate is constant.

5.2.4 *transmission area* — a part of the transmission cell, the part where the actual water vapor permeates except the seal part of the sample.

5.2.3 *transmission cell* — two chambers, a dry chamber, and a wet chamber between which a specimen is mounted.

5.2.5 *turbomolecular pump (TMP)* — a type of vacuum pump used to obtain and maintain high vacuum.

5.2.6 *water vapor transmission rate* — time rate of water vapor transmission through a unit area (1 m^2) of parallel surfaces of a plastic film per unit time (24 hours) under specified temperature and humidity conditions. [SEMI D66]

5.2.7 *wet chamber* — a part of the transmission cell. The transmission cell is divided by the sample, and wet chamber is placed on the water vapor supply side.

6 Summary of Test Method

6.1 *Preparation of Test Samples* — Prepare plastic films with high gas barrier, which the size is at least 10 mm larger than transmission area.

6.2 *Measurement of Test Samples* — Store test samples in a temperature and humidity chamber after initial status is confirm.

6.3 *Evaluation of Test Result* — Continue measurement until steady state, subtract pre-measured background.

6.4 *Test Report* — Report the evaluation result.

7 Apparatus

7.1 General

7.1.1 An example of suitable apparatus is shown in Figure 1. The apparatus includes a transmission cell, a quadrupole mass spectrometer as detector to determine the amount of water vapor transmitted, vacuum pumps to realize ultra-high vacuum, and water tank.

7.1.2 *Transmission Cell* — The diameter of the test cell shall be at least 10 mm larger than transmission area. The temperature of the transmission cell shall be kept within $\pm 0.5^\circ\text{C}$ of the test temperature by means of a temperature controller.

7.1.3 *Water Tank* — The water tank that contains distilled or deionized water is connected to the wet chamber. The temperature of the water in the reservoir shall be kept at the temperature of the transmission cell.

7.1.4 *Vacuum Pump* — The vacuum pumps shall be capable of producing an ultimate high vacuum of 10^{-6} Pa or less shall be used.

NOTE 1: For example, tandemly connected two TMPs to realize ultimate high vacuum of 10^{-6} Pa or less are available.