

SEMI G66-96 (Reapproved 1104)

TEST METHOD FOR THE MEASUREMENT OF WATER ABSORPTION CHARACTERISTICS FOR SEMICONDUCTOR PLASTIC MOLDING COMPOUNDS

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1 Purpose

1.1 This method describes a procedure for measuring the water absorption rate for plastic molding compounds and provides a method to calculate the diffusion and solubility coefficients, which are required to simulate the water absorption characteristics.

2 Scope

2.1 This method may be applied to all semiconductor plastic molding compounds.

2.2 This method may be used to characterize molding compounds in development.

2.3 Packaging engineers may simulate the water absorption characteristics and their significance in relation to package cracks at soldering by using calculated diffusion and solubility coefficients.

NOTICE: This standard does not purport to address safety issues, if any, associated with its use. It is the responsibility of the users of this standard to establish appropriate safety and health practices and determine the applicability of regulatory or other limitations prior to use.

3 Referenced Standards

3.1 None.

4 Terminology

4.1 Definitions

4.1.1 *diffusion coefficient, D* — the diffusion rate of water into a molding compound (see Appendix 1 and Figure 1).

4.1.2 *solubility coefficients, S* — ratio of saturated moisture concentration in molding compounds to partial pressure of moisture in environment (see Appendix 1 and Figure 1).

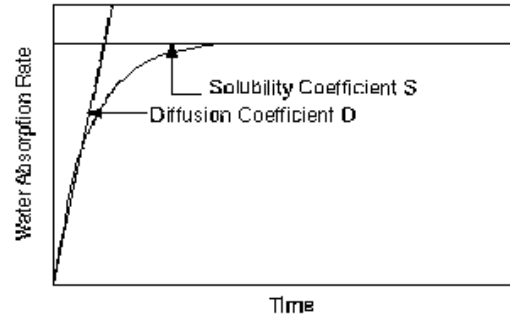


Figure 1
Concept of Diffusion and Solubility Coefficients

5 Summary of Method

5.1 This method is based on the measurement of the increase in weight, due to water absorption, after exposing the molding compound to a high-temperature, high-humidity environment.

6 Equipment

6.1 *Balance* — An analytical balance capable of reading 0.0001g.

6.2 *High-Temperature Chamber* — Capable of maintaining a uniform temperature of $125 \pm 3^\circ\text{C}$.

6.3 *Temperature/Humidity Chamber* — Capable of maintaining a uniform temperature of $85 \pm 2^\circ\text{C}$ and $85 \pm 5\%$ relative humidity.

6.4 *Desiccator (1)* — To hold specimens during cool-down from high-temperature conditioning.

6.5 *Desiccator (2)* — This desiccator, with water in the bottom rather than drying compound, is to hold the specimens after exposure to heat and humidity.

6.6 Mold for specimen preparation.

7 Reagents and Materials

7.1 *Deionized Water* — Resistivity $\geq 15\text{M ohm-cm}$ at 25°C

8 Sampling Plan

8.1 At least three samples shall be chosen for each molding type for each test.

9 Test Specimens

9.1 Test specimens are required as follows:

9.1.1 Specimens for diffusion area.

9.1.1.1 *Diameter* — 50 ± 1 mm

9.1.1.2 *Thickness* — 3 ± 0.2 mm

9.1.2 Specimens for saturated area.

9.1.2.1 *Diameter* — 50 ± 1 mm

9.1.2.2 *Thickness* — 1 ± 0.2 mm

10 Equipment Set-Up

10.1 Refer to manufacturer's operation manuals.

11 Procedure

11.1 *Specimen Preparation*

11.1.1 Prepare the specimens by molding samples using the specimen mold and conditions recommended by the molding compound manufacturer.

11.1.2 Post-mold cure the specimens to recommended conditions using the high-temperature chamber.

11.2 *Specimen Conditioning*

11.2.1 Dry the specimens at 125°C in the high-temperature chamber for 24 hours minimum.

NOTE 1: If the samples are already dry (e.g., samples directly from post-mold cure), additional conditioning is not required.

11.2.2 Place the specimens in the desiccator (1) and allow to cool to room temperature.

11.2.3 Weigh the specimens to the nearest 0.0001g.

11.3 Water Absorption Exposure and Reconditioning

11.3.1 *Diffusion Area*

11.3.1.1 Place the conditioned specimens (3 mm thickness) in the high-temperature/humidity chamber set at 85°C and 85% relative humidity for 24 ± 1 hours.

NOTE 2: The specimens should be placed to avoid any contact with each other and with the walls of the chamber, e.g. to use a holder or to place on a wire net.

11.3.1.2 Remove the specimens from the chamber and wipe off any excess water from the surfaces with a clean cloth or absorbant paper.

11.3.1.3 Place the specimens in desiccator (2) and allow to cool to room temperature.

NOTE 3: The specimens should be placed to avoid any contact with each other and with the walls of the chamber (e.g., to use a holder or to place on a wire net).

11.3.1.4 Re-weigh the specimens to the nearest 0.0001 g.

11.3.2 *Saturated Area*

11.3.2.1 Place the conditioned specimens (1 mm thickness) in the high-temperature/humidity chamber set at 85°C and 85% relative humidity for 168 ± 4 hours.

NOTE 4: The specimens should be placed to avoid any contact with each other and with the walls of the chamber (e.g., to use a holder or to place on a wire net).

11.3.2.2 Remove the specimens from the chamber and wipe off any excess water from the surfaces with a clean cloth or absorbant paper.

11.3.2.3 Place the specimens in desiccator (2) and allow to cool to room temperature.

NOTE 5: The specimens should be placed to avoid any contact with each other and with the walls of the chamber, e.g. to use a holder or to place on a wire net.

11.3.2.4 Re-weigh the specimens to the nearest 0.0001g.

12 Calculations

12.1 *Water Absorption Rate* — The rate is calculated as follows:

12.1.1 Water absorption rate (wt%) = $\left(\frac{M2 - M1}{M1} \right) \times 100$ (1)

Where:

M1 is the initial conditioned weight, and

M2 is the reconditioned weight after exposure to temperature/humidity

12.2 *Diffusion and Solubility Coefficients*

12.2.1 There are various methods to calculate diffusion and solubility coefficients. See Appendix 1 for one of these methods.

13 Report

13.1 The following information shall be reported:

13.1.1 Manufacturer and identification of molding compound

13.1.2 Specimen sizes

13.1.3 Test conditions

13.1.4 Water absorption rate