

SEMI G31-0997

TEST METHOD FOR DETERMINING THE ABRASIVE CHARACTERISTICS OF MOLDING COMPOUNDS

1 Purpose

This document describes the method to measure the abrasive characteristics of molding compounds by measuring mold orifice weight loss as a function of molded volume.

2 Scope

2.1 All thermoset molding compounds used for microelectronic device encapsulation contain filler materials, typically 60–90% — which contribute to mold wear. Mold wear, typically at gates, is a major reason for mold rework. This test method may be used by suppliers to evaluate new molding materials or control current materials or by customers to evaluate the use of new materials. This test method provides a comparison of abrasiveness between materials.

2.2 This procedure can be used to determine the abrasive character of a given molding compound. Knowing the conditions of test, the results of the test, and the mold life experience (within one's own company) in the field, it is possible to judge if a molding compound is more or less abrasive to current compound in use.

3 Referenced Documents

3.1 Operational manuals for all equipment listed within this document.

3.2 Mold compound data sheets

4 Method

This procedure determines the abrasive character of a given filled molding compound by measuring orifice weight loss as a function of extruded volume.

5 Interferences

5.1 Care must be taken to avoid orifice weight loss by mishandling during placing and removing the orifice from the mold base.

5.2 Before the orifice is re-weighed after molding, carefully remove all contamination.

6 Equipment

6.1 Transfer molding press, 50 tons clamp minimum

6.2 Dielectric preheater

6.3 Orifice insert and mold assembly (See Figures 2–6.)

6.4 Mold base with pot diameter 1.75 to 2.00 inches

6.5 Photoelectric safety light screen

6.6 Stop watch

6.7 Pyrometer

6.8 Force gauge

6.9 Asbestos gloves

7 Procedure

7.1 *Equipment Set-Up* — Orifice Mold Installation (see Figure 1).

7.1.1 Place mold assembly on mold base and align orifice retainer opening with center of transfer pot.

7.1.2 Clamp bottom plate of mold assembly to bottom mold platen.

7.1.3 Set press limit switch to ensure clamp slow close is initiated 1" from completion of mold closing.

7.2 *Process Parameters*

7.2.1 Set up the molding parameters according to the material data sheet recommendations or expected use conditions, if known. These conditions include:

- Mold temperature
- Pre-heat temperature or pre-heat time
- Transfer speed
- Transfer pressure
- Clamp pressure
- Cure time

NOTE: The charge weight to be determined by trial molding shots to achieve a cull thickness between 0.060–0.120" and a suitable weight of extrudate.

7.3 *Operating Procedure*

7.3.1 Weigh orifice to one ten-thousandth of a gram. Record weight.

7.3.2 Verify process parameter settings.

7.3.3 Place orifice in orifice retainer and clamp mold assembly.

7.3.4 Preheat preformed material to the required temperature.

7.3.5 Insert preheated material into transfer pot and activate transfer ram (semi-automatic mode).

7.3.6 Start stopwatch when extrudate first appears. Record total extrusion time.

7.3.7 Collect and weigh extrudate to nearest one tenth of a gram. Record extrudate weight.

7.3.8 At the end of cure cycle, remove orifice from retainer. Loosen set-screws to split orifice and, with compressed air, blow out cured slug.

7.3.9 Ensure mating orifice halves are clean, realign the halves and tighten set screws.

7.3.10 Place orifice in retainer and repeat steps 7.3.4 through 7.3.9.

7.3.11 Repeat steps 7.3.4 through 7.3.10 until a minimum of 40 shots are run.

7.3.12 Record the following:

1. Original orifice weight
2. Shot number
3. Extruded weight per shot in grams
4. Cumulative extruded weight in grams
5. Orifice weight in grams
6. Orifice percent weight loss
7. Extrusion rate

8 Calculation

8.1 Orifice Weight Loss

$$\frac{I_O - I_N}{I_O} (100\%) = \% \text{ wt. loss}$$

I_O = Initial orifice weight to ten thousandth of a gram

I_N = Orifice weight after "N" number of shots to ten thousandth of a gram

8.2 Plot on linear graph paper the orifice weight loss vs. cumulative extruded weight.

8.3 Convert cumulative weight extruded to cumulative volume extruded.

Example: Molding compound density 2.0 g/cm³
cumulative weight = 2000 g

$$2000 \text{ g} \times \frac{\text{cm}^3}{2.0 \text{ g}} = 1000 \text{ cm}^3$$

8.4 Convert cumulative volume extruded to equivalent production mold shots.

Example: 28 mm × 28 mm × 3.4 mm - 208 Id PQFP

Package Volume:

$$28 \text{ mm} \times 28 \text{ mm} \times 3.4 \text{ mm} \times \frac{\text{cm}^3}{1000 \text{ mm}^3} = 2.6656 \text{ cm}^3$$

Volume to shots:

$$1000 \text{ cm}^3 \times \frac{\text{shot}}{2.6656 \text{ cm}^3} = 375 \text{ shots}$$

8.5 Plot on linear graph paper the orifice weight loss vs. equivalent production mold shots.