

SEMI G52-90 (Reapproved 1104) STANDARD TEST METHOD FOR MEASUREMENT OF IONIC CONTAMINATION ON SEMICONDUCTOR LEADFRAMES (PROPOSED)

This test method was technically approved by the Assembly & Packaging Global Technical Committee and is the direct responsibility of the Japanese Packaging Committee. Current edition approved by the Japanese Regional Standards Committee on July 23, 2004. Initially available at www.semi.org September 2004; to be published November 2004. Originally published in 1990.

NOTE 1: Japan, Europe, and US task forces are planning to develop test methods which will address the different levels of ionic contamination on leadframes.

1 Scope

1.1 This standard describes the procedure to determine ionic contamination on leadframes using a water extraction method. The method is sensitive to Na^+ , NH_4^+ , K^+ , Cl^- , NO_3^- , Br^- , SO_4^{2-} , PO_4^{3-} .

NOTICE: SEMI Standards and Safety Guidelines do not purport to address all safety issues associated with their use. It is the responsibility of the users of the Documents to establish appropriate safety and health practices, and determine the applicability of regulatory or other limitations prior to use.

2 Referenced Standards and Documents

2.1 ASTM Standards¹

ASTM D1193 — Specification for Reagent Water

ASTM D4327 — Anions in Water by Ion Chromatography

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

3 Summary of Method

3.1 Ionic contamination is extracted in water at $>95^\circ\text{C}$ for 30 ± 2 minutes. The contamination is quantitatively analyzed by ion type using Ion Chromatography and the result is presented as nanograms/unit area.

4 Significance

4.1 Contamination on leadframes can contribute to semiconductor device reliability problems. This method may be used by lead frame manufacturers at outgoing inspection and by users at incoming inspection. Correlation of device reliability with contamination levels may lead to improved leadframe cleaning processes.

5 Terminology

5.1 Definitions

5.1.1 *eluent* — the solvent used to carry the extracted ions through the ion exchange chromatograph.

5.1.2 *regenerant* — a chemical solution containing the ions originally present in the chromatograph column prior to a test run and used to prepare the column for a new test.

5.1.3 *retention time* — the time required for a particular ion type to pass from the injection port to the detector. Retention time is characteristically different for each ion type.

5.1.4 *standard solution* — a solution containing a known concentration of the ion to be measured and used to calibrate the chromatograph.

6 Equipment

6.1 *Ion Chromatograph for Anion and Cation Analysis* — This equipment is to consist of a concentration pump, guard column, separator column, and a detector module consisting of a suppressor device to reduce the background

¹ ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA; Telephone: +1.610.832.9585, Fax: +1.610.832.9555, <http://www.astm.org>

eluent conductivity to a low level and a conductivity cell. The minimum sensitivity of the chromatograph for each ion type is defined in Table 1.

6.2 Chart Recorder

6.3 *Ion Extraction Vessels* — Polypropylene or teflon containers with sealing caps, or polypropylene/ polyethylene double layered bags.

NOTE 2: The contamination level of these vessels must be less than one-fifth (1/5) of the expected contamination level on the leadframes when measured in a control test.

6.4 Hot Bar Bag Sealer

6.5 *Water Bath* — 300 mmL × 300 mmW × 200 mmH, filled with DI water, and capable of holding 95°C.

6.6 *Volumetric Dispenser (e.g., Pipettes)* — 10 mL and 100 mL capacity.

6.7 *Quartz Flasks and Pipettes for Cation Standard Solutions* — 100, 250, 500, and 1000 mL capacity (flasks); 1, 10, and 25 mL capacity (pipettes).

6.8 *Borosilicate Glass Flasks and Pipettes for Anion Standard Solutions* — 100, 250, 500, and 100 mL capacity (flasks); 1, 10, and 25 mL capacity (pipettes).

6.9 Chemical Balance, Weighing Chemicals

6.10 Scissors, Tweezers, Spatula

7 Reagents and Materials

7.1 Deionized water, resistivity ≥ 15 megohm centimeters at 25°C per ASTM D1193.

7.2 Eluents and regenerants for specific chromatograph columns prepared per chromatograph equipment manufacturer's recommendations so that the water peak can be separated from the ionic peaks.

7.3 *Compounds for Cation Standard Solutions* — NaCl, NH₄Cl, KCl.

7.3.1 *Compounds for Anion Standard Solutions* — NaCl, Na₂HPO₄, 12H₂O, NaBr, NaNO₃, K₂SO₄.

NOTE 3: All compounds are to be reagent grade.

8 Sampling

8.1 The leadframes must not be touched, except with previously cleaned tweezers or double-layered cotton gloves with polyethylene outer gloves in order to avoid additional contamination.

8.2 The sample size (i.e., the number of frames to be tested in this destructive test) may be determined by agreement between the customer and the vendor. The recommended sample sizes are 10 to 50 cm² for testing pads and 200 to 500 cm for the test of overall leadframes.

NOTE 4: The surface area of the frame is calculated from the leadframe drawing, and includes the top, bottom and side surfaces. It is important that user and supplier agree on the surface area calculation for any given leadframe configuration.

9 Preparation of Standard — Solutions and Chromatograph Calibration

9.1 Standard Solutions

9.1.1 The single-ingredient standard solutions of each ion (Na⁺, NH₄⁺, K⁺; Cl⁻, NO₃⁻, Br⁻, SO₄²⁻, PO₄³⁻) are made by dissolving 1.000 g of each ion into 1.000 liter of D.I. water, respectively. The stored multi-ingredient standard solutions shown in Table 2 are then made from these single-ingredient standard solutions by the dilution method.

9.1.2 Cation and anion standard solutions for calibration are made by diluting the stored multi-ingredient standard solutions as shown in Table 2.

9.1.3 Store the multi-ingredient standard solution and the calibration solutions in the correct flasks and label with the ion type and concentration.

NOTE 5: New standard solutions for calibration are required every 24 hours. Ensure that the flasks are cleaned with water before refilling with a new solution.