ASSOCIATION CONNECTING
ELECTRONICS INDUSTRIES

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Number	
2.6.16.1	
Subject	
Moisture Resistance of High Density Interconnection (HDI) Materials Under High Temperature and Pressure (Pressure Vessel)	
Date	Revision
8/98	
Originating Task Group	
HDI Test Methods Task Group (D-42A)	

IPC-TM-650
TEST METHODS MANUAL

1 Scope This test method is designed to determine the capability of HDI materials and other dielectrics to withstand moisture induced stress as applied by extended time in a pressure vessel. For laminated constructions, the results may be affected by the process conditions.

2 Applicable Documents

IPC-A-600 Acceptability of Printed Boards

IPC-TM-650 Test Methods Manual

2.1.1 Microsectioning

2.1.1.2 Microsectioning—Semi or Automatic Technique Microsection Equipment (Alternate)

2.3.6 Etching, Ammonium Persulfate Method

2.3.7 Etching, Ferric Chloride Method

2.3.7.1 Cupric Chloride Etching Method

2.3.7.2 Alkaline Etching Method

3 Test Specimen

3.1 Samples shall be prepared as appropriate for the type of material. All samples shall be 10 cm x 10 cm ± 0.5 cm, with the thickness determined by the type of material (see 3.1.1 to 3.1.3). Three samples shall be prepared. Control samples are required for all samples where the dielectric layer is applied to an etched laminate. One control sample of the etched laminate (with no added dielectric) is required for samples prepared according to 3.1.2.2 or 3.1.3.

3.1.1 Copper-Clad Laminate The laminate shall have all copper removed in accordance with IPC-TM-650, Method 2.3.6, 2.3.7, 2.3.7.1 or 2.3.7.2, then cut to dimensions of 10 cm x 10 cm ± 0.65 cm.

3.1.2 Semi-Cured Prepreg The prepreg shall be laminated to a cured sheet configuration, with 35 micron copper foil, using the supplier's recommended lamination cycle. The laminate shall be etched of all copper, then cut to dimensions of 10 cm x 10 cm ± 0.65 cm.

3.1.2.1 Semi-Cured Prepreg or Dielectric Material, Method A Sufficient plies of prepreg shall be used to result in a composite base thickness of 0.4 mm ± 0.1 mm. If the prepreg is of a nature that does not allow for lamination of a single sample of the thickness specified, then a thinner sample shall be laminated, noting the thickness as part of the report, see 5.5.

3.1.2.2 Semi-Cured Prepreg or Dielectric Material, Alternate Method B The prepreg or dielectric layer shall be laminated to both sides of an etched laminate that has a thickness of 0.4 mm ± 0.1 mm. The prepreg or dielectric layer shall be applied, laminated and cured according to the manufacturer's recommendations. Unless otherwise specified, the resulting prepreg or dielectric layer thickness shall be a nominal of 0.05 mm on each side of the core laminate. Optionally, the actual thickness may be measured by mechanical or cross-sectional methods and reported, see 5.5. Control samples shall be the etched laminate core with no prepreg or dielectric layer.

3.1.3 Coated Dielectrics The coated dielectrics (i.e., resins, adhesives, dry films) shall be applied to both sides of an etched laminate that has a thickness of 0.4 mm ± 0.1 mm. The coated dielectrics shall be applied and cured according to the manufacturer's recommendations. Unless otherwise specified, the resulting coated dielectric thickness shall be a nominal of 0.05 mm on each side of the core laminate. Optionally, the actual thickness may be measured by mechanical or cross-sectional methods and reported, see 5.5. Control samples shall be the etched laminate core with no coated dielectric.

4 Test Equipment

4.1 Pressure vessel capable of maintaining a constant pressure of 2 ATM (14 psig), and a temperature of 121°C ± 2°C, with water content maintained for a minimum of six hours before needing replenishment.

4.2 Oven, air circulating, capable of holding a temperature of 105°C ± 2°C

4.3 Microsectioning equipment, including slug cutter, mounting, grinding, and polishing equipment (see IPC-TM-650, Method 2.1.1 or 2.1.1.2)

4.4 Microscope capable of 200X magnification, with optional photographic equipment

5 Procedure

5.1 Prepare specimens as required, depending on the configuration of the material under test (see 3.1).

5.2 Preconditioning The samples and controls shall be dried by baking at 105°C ± 2°C for a minimum of two hours to remove moisture.

5.3 Expose to Moisture Under Pressure

5.3.1 Place three pieces of each type of material to be tested in the pressure vessel, such that they are vertical by use of a rack or grooved block, which does not cover more than 5% of the surface area of the specimen. If samples have been prepared as per 3.1.2.2 and 3.1.3, place one piece of the base laminate in the vessel along with the specimens.

5.3.2 Fill the pressure vessel with water such that the specimens are not sitting in the water.

5.3.3 Close the lid of the pressure vessel and seal the chamber.

5.3.4 Apply heat to the pressure vessel until the temperature and pressure specified are attained and held constant.

5.3.5 Water must be replenished during the pressure vessel test to maintain the prescribed pressure level. The interval of replenishment should not be less than six hours.

5.3.6 After the required time, which shall be 96 hours unless otherwise specified, remove the pressure cooker from the heat source and open the chamber. Remove the specimens and lay on a countertop to stabilize at room temperature.

5.4 Evaluation

5.4.1 Inspect the surface area of the specimens using 20/20 vision. When applicable, refer to IPC-A-600 to assess degradation, such as measling or crazing.

5.4.1.1 Determine and grade the presence of any degradation (see 5.5.1.1 through 5.5.1.5) or other defects, such as measling, dryness, loss of surface resin, etc. Use the unconditioned specimen from each sample as a control to contrast with the conditoned specimens. For samples prepared as per 3.1.2.2 or 3.1.3, use the base laminate as control.

5.4.1.2 Record any defects or degradation of the material. Note the presence of any defects in the unconditioned control. Include the approximate number and size of defects and the total area of the specimen surface that is afflicted with the defect(s).

5.4.2 When required by the procurement documentation, microsectioning shall be conducted as stated in 5.4.2.1 through 5.4.2.3.

5.4.2.1 Cross section at least one specimen in the center of the specimen in accordance with Method 2.1.7. Mount a section of the control of that material beside the conditioned section.

5.4.2.2 After polishing the sections, examine under 100 - 200X.

5.4.2.3 Determine the presence of voids, resin-to-reinforcement separation, or other defects in both the control and the conditioned specimen.

5.5 Report Report the base thickness of the laminate. For prepregs or coating et al, if a composite sample is fabricated, include the final thickness of the material in question and the thickness of the core laminate.

5.5.1 Report the condition of the specimens according to the following grade system. If significant differences are noted between specimens of one material, note the worse condition. Exclude the outer 7 mm.

5.5.1.1 Grade 5 No measling, delamination, dryness, voiding or other degradation in excess of that observed on the unconditioned sample.

5.5.1.2 Grade 4 Very slight measling; or slight dryness.

5.5.1.3 Grade 3 Slight measling or dryness; or maximum, of three voids no greater than 0.25 mm.

5.5.1.4 Grade 2 Moderate measling or dryness; moderate dryness; or more than three voids no greater than 0.5 mm.

5.5.1.5 Grade 1 Heavy measling and dryness; or voids greater than 0.5 mm; blisters or delamination.

5.5.2 Optional Microsectioning Evaluation Report the presence of defects in both control and conditioned specimens.