Designation: D 1825 – 03

An American National Standard

Standard Practice for Etching and Cleaning Copper-Clad Electrical Insulating Materials and Thermosetting Laminates for Electrical Testing[1]

This standard is issued under the fixed designation D 1825; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice describes a procedure for etching and cleaning copper-clad electrical insulating materials and thermosetting laminates for electrical testing.

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific warning statements see 6.3 and 6.4.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

D 1867 Specification for Copper-Clad Thermosetting Laminates for Printed Wiring

3. Significance and Use

3.1 The procedure used for etching the copper foil from the base insulating materials may significantly affect the results of electrical tests. This is true primarily for two reasons. First, the geometry of the copper which remains and forms the electrodes is in part determined by the etching procedure; this is particularly true of closely spaced electrodes on the same surface when the property to be measured depends on the electrode geometry. Second, electrical conductance in the material, particularly surface conductance, may be affected by the chemicals used to etch the copper, the length of time of etching, and the manner in which the specimen is cleaned after etching.

3.2 This practice standardizes the etching procedure in order to provide a basis for comparison of electrical properties of copper-clad electrical insulating materials and thermosetting laminates. Experience has shown that the test circuit can be accurately prepared using this procedure, and that the specimen will be substantially free of etching-induced, electrically-conductive contaminants.

3.3 It is recognized that commercial processes utilized to manufacture printed circuits may differ appreciably from this practice. Therefore, the results of tests on specimens etched in accordance with this practice may differ from results obtained on specimens etched in a commercial process. Specimens should be etched in accordance with a procedure different from this practice, if it is desired to determine the influence of the different procedure on electrical properties.

4. Reagents and Materials

4.1 *Ferric Chloride Etching Solution* (554 g/L)—Dissolve 554 g of ferric chloride ($FeCl_3$) or 925 g of the hydrate ($FeCl_3 \cdot 6H_2O$) in water and dilute to 1 L.

4.2 *Oxalic Acid Solution (10 %)*— Dissolve 103.5 g of oxalic acid in water and dilute to 1 L.

4.3 *Pumice*, Grade FFF.

5. Test Specimen

5.1 Prepare the test specimen to consist of an area of suitable size of any copper-clad electrical insulating sheet material or a thermosetting laminate such as described in Specification D 1867, or an actual finished printed circuit element.

6. Procedure

6.1 Etch the test specimen with vigorous aeration for a minimum time (Note 1) in $FeCl_3$ solution maintained at 24 to 45°C. Renew the etching solution when the etching time exceeds 15 min for 1-oz copper or 30 min for 2-oz copper.

NOTE 1—The time to produce a clean pattern with a minimum of undercutting is approximately 7 min for 1-oz copper and 15 min for 2-oz copper, using fresh $FeCl_3$ solution.

[1] This practice is under the jurisdiction of ASTM Committee D09 on Electrical and Electronic Insulating Materials and is the direct responsibility of Subcommittee D09.07 on Flexible and Rigid Insulating Materials.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

6.2 After removal of the copper, immediately wash the specimen with running tap water at 16 to 32°C for 2 to 5 min. Thereafter, keep the specimen from drying and proceed without delay until reaching the step described in 6.7.

6.3 Immerse the specimen in a 10 % solution of oxalic acid in water at 16 to 32°C for 15 to 20 min. Provide gentle circulation of the oxalic acid solution during this period. (**Warning**—Oxalic acid is toxic, handle with precautions applicable for using toxic materials in the laboratory. Flush the specimen with running tap water at 16 to 32°C.)

6.4 Scrub the specimen with Grade FFF pumice to remove the resist, or wipe off the resist with a lint-free cloth moistened with a suitable cleaning/degreasing solvent. (**Warning**—Provide adequate ventilation and avoid the presence of open flames. In cleaning, exercise care to avoid abrading the adhesive layer with pumice, or attacking the adhesive or laminate with the solvent.)

NOTE 2—Pumice may damage the surface of some materials; also, care should be taken to select a solvent that does not soften or otherwise damage the insulating material.

6.5 Scrub the specimen with a plastic-bristled brush under running tap water at 16 to 32°C and rinse for 30 min.

6.6 Rinse the specimen in distilled water.

6.7 Dry the specimen for 1 h in an oven at 80 ± 3°C (Note 3). Handle only with nylon or other lint-free gloves when drying and for the remainder of the procedure.

NOTE 3—Some materials may be damaged by this temperature. Whenever there is a question of damage, drying at 40 ± 3°C for 16 h should be substituted.

6.8 Inspect the etched pattern on the specimen carefully for visual defects.

7. Keywords

7.1 cleaning; copper-clad laminates; etching; thermosetting laminates