



## Standard Test Method for Exothermic Temperature of Encapsulating Compounds for Electronic and Microelectronic Encapsulation<sup>1</sup>

This standard is issued under the fixed designation F 542; 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 test method provides results that are related to the maximum temperature reached in a specific volume by a reacting liquid encapsulating compound, and the time from initial mixing to the time when this peak exothermic temperature is reached.

1.2 This test method provides a means to measure the peak exothermic temperature of an encapsulating compound.

1.3 *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 hazard statements see Section 8.

### 2. Referenced Documents

#### 2.1 ASTM Standards:

D 1711 Terminology Relating to Electrical Insulation<sup>2</sup>

D 5423 Specification for Forced-Convection Laboratory Ovens for Evaluation of Electrical Insulation<sup>3</sup>

### 3. Terminology

3.1 *Definitions:* For definitions of terms used in this test method, refer to Terminology D 1711.

#### 3.2 Definition of Term Specific to This Standard:

3.2.1 *encapsulating compound, n*—a resin system used to encase electronic components.

3.2.1.1 *Discussion*—These resins are generally used to provide protection from the operating environment and mechanical damage.

### 4. Summary of Test Method

4.1 A thermocouple is used to measure the highest temperature at the geometric center of a volume of encapsulating compound in order to characterize the heat generated by the chemical exothermic reaction.

### 5. Significance and Use

5.1 Heat generated by a reacting liquid encapsulating compound may cause damage to heat-sensitive electronic components. Degradation of the encapsulating compound may also occur at high temperatures. Proper selection of an encapsulate must include knowledge of its exothermic temperature to preclude damage to components.

5.2 Since the exothermic temperature of a reacting encapsulating compound varies with the volume and geometry of material, it is essential that the volume and geometry be specified in any determination. By selection of an appropriate volume and geometry, the exothermic temperature may be measured in sufficiently precise and reproducible form for application evaluation, quality control, and encapsulating compound characterization.

5.3 Materials may be compared by testing equal volumes of each material using the same geometry. Two different volumes of the same material in similar geometries may be tested to determine the effect of volume on the exothermic temperature.

### 6. Interferences

6.1 Under normal electronic system encapsulation, the heat sink of the components would reduce the maximum heat generated in the encapsulating compound. Since the volume and geometry of the electronic system, plus the heat sink of the components, affect the exothermic temperature of the encapsulating compound, it is recommended that actual hardware be tested in cases in which temperature-sensitive electronics are utilized.

### 7. Apparatus

7.1 *Specimen Containers* for specific test volumes, as follows:

7.1.1 For 50-mL test, borosilicate glass beaker, Griffin,

7.1.2 For 125-mL test, “No. 202 × 204” standard canning industry 130 mL can, 54.0 mm in diameter by 57.1 mm in height,

7.1.3 For 150-mL test, borosilicate glass beaker, Griffin, low-form,

7.1.4 For 200-mL test, “No. 202 × 314” standard canning industry 225 mL can, 54.0 mm in diameter by 98.4 mm in height, or

7.1.5 For 300-mL test, “No. 211 × 400” standard canning

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D-9 on Electrical and Electronic Insulating Materials, and is the direct responsibility of Subcommittee D 09.01 on Electrical Insulating Varnishes, Powders, and Encapsulating Compounds.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 10.01.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 10.02.