Designation: D352 – 23

Standard Test Methods for Pasted Mica Used in Electrical Insulation[1]

This standard is issued under the fixed designation D352; 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 These test methods cover the testing of bonded mica splittings and bonded mica paper to be used for commutator insulation, hot molding, heater plates, and other similar insulating purposes.

1.2 These test methods appear in the following sections:

Test	Sections
Compressive Creep	4 – 10
Dielectric Strength	38 – 41
Mica or Binder Content	19
Molding Test	31 – 36
Organic Binder	20 – 24
Resistivity	42 – 46
Silicone Binder	25 – 30
Stability Under Heat and Pressure	11 – 18

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* See 40.1 and 45.1 for specific hazard statements.

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D149 Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies

D257 Test Methods for DC Resistance or Conductance of Insulating Materials

D1711 Terminology Relating to Electrical Insulation

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms relating to electrical insulation, refer to Terminology D1711.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *binder content, n,* (of pasted mica)—the percent by weight of binder relative to the original weight of a specimen as determined by procedures specified herein.

3.2.1.1 *Discussion*—Binder content includes any residual solvent. Pasted mica materials not fully cured (such as molding and flexible plates) possibly contain appreciable quantities of solvent in the binder. This solvent is usually later removed when the material is cured in the manufacture of electrical equipment. In such cases, the binder content after cure is less (by the amount of solvent removed) than would be determined by this method. To determine the binder content after cure of materials that are not fully cured, but subsequently will be, it is necessary, before initially weighing the specimen, to heat the specimen for a time and at a temperature that depends upon the material from which the specimen is prepared.

3.2.2 *compressive creep, n*—the change in thickness of a bonded micaceous material resulting from exposure to elevated temperature for a specified time while a specimen is under a specified compressive load.

3.2.3 *mica content, n,* (of pasted mica)—the percent by weight of mica relative to the original weight equal to 100 % minus the binder content as determined by procedures specified herein.

COMPRESSIVE CREEP

4. Significance and Use

4.1 This test determines the compressive creep under laboratory conditions or under conditions that are possibly encountered during manufacture of electrical equipment. It has special significance if the material to be tested is applied as commutator segment insulation. It serves as a measure under specified conditions of the ability of the material to resist deformation

[1] These test methods are under the jurisdiction of ASTM Committee D09 on Electrical and Electronic Insulating Materials and are the direct responsibility of Subcommittee D09.01 on Electrical Insulating Products.

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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.

while under compressive load, during exposure to elevated temperature for a specified time. This test is suitable for acceptance tests and for manufacturing control.

5. Apparatus

5.1 *Hydraulic Press*—A hydraulic press having temperature controlled, electrically heated platens, or a press with other provisions for heating the specimen and controlling the temperature. The platens shall be at least 4 by 4 in. (102 by 102 mm) in size. The press shall be capable of exerting a force of at least 4000 lb (18 kN). The apparatus shall be capable of maintaining a specimen temperature of at least 200 °C ± 5 °C. It is preferable that the apparatus have platens with water ducts or other provisions for cooling the specimen. (See Note 1 in 7.3.)

5.2 *Pressure Gauge*—A pressure gauge capable of determining the pressure on the specimen with an accuracy of ±5 %.

5.3 *Thickness Gauge*—A thickness gauge capable of measuring the thickness of the specimen to the nearest 0.001 in. (0.025 mm).

5.4 *Potentiometer*—Temperature measuring instrument and a No. 30 AWG or smaller thermocouple with overall accuracy of ± 2 °C for measurement of specimen temperature.

5.5 *Steel Plates*—Two 4 by 4-in. (102 by 102 mm) or larger polished steel plates of at least 1/16-in. (1.6 mm) thickness, surface ground so that the top and bottom surfaces of each piece are parallel, one plate each for the top and bottom of the test specimen.

6. Test Specimen

6.1 The test specimen shall consist of a sufficient number of pieces of bonded micaceous plate, 2 by 2 in. (51 by 51 mm) in size, to form a stack approximately but not greater than 1.000 in. (25.40 mm) in thickness. The pieces shall be selected so as to be representative of the entire sheet. At least three specimens shall be tested for each lot of material.

7. Procedure

7.1 Center the stacked specimen between the 4 by 4-in. (102 by 102 mm) steel plates and then center this assembly in the press. Place the thermocouple between pieces near the middle of the stack. Carefully align the stack to form a right parallelepiped. Apply a pressure of 1000 psi (7 MPa) to the specimen surfaces, and carefully determine the average thickness of the stack by means of the gauge. Where inside gauges are used, measure the thickness at each of the four corners as close to the specimen as possible. Measurements shall be made within 5 min.

7.2 Pack approximately 2 in. (51 mm) of thermal insulation material around the specimen without disturbing it. Heat the specimen to 160 °C ± 5 °C or 200 °C ± 5 °C as specified. The time required to reach the specified temperature shall be not less than 30 min nor more than 75 min. The platen temperature shall not exceed the specified temperature by more than the specified tolerance. If the specimen is heated by other means, the surrounding medium shall not exceed the specified temperature by more than the specified tolerance. Allow the specimen to remain at the specified temperature for 2 h after reaching that temperature, and at the same time maintain the 1000-psi pressure.

7.3 Remove the thermal insulation and, while maintaining the pressure, allow the specimen to cool until the temperature is 5 °C above the temperature (room ambient) at which the original thickness was measured. Control the rate of cooling such that it does not exceed the rate at which the temperature was raised. Then determine the thickness of the stack while under 1000-psi compressive load.

NOTE 1—Experience has shown that in order to cool the specimen to the specified temperature within a reasonable time, forced-cooling means must be employed. It is suggested that a fan be initially utilized to force air across the specimen for the first 5 min, after which cooling it is allowable to circulate in ducts provided in the platens. The rate of water flow, if used, shall be adjusted to give a cooling rate no greater than the rate at which the specimen was initially heated.

8. Calculation

8.1 Calculate the percentage compressive creep, C, as follows:

$$C, \% = [(T - T')/T] \times 100 \quad (1)$$

where:

T = thickness of the stack at 1000 psi (7 MPa) before heating, and
T' = thickness of the stack at 1000 psi after heating.

9. Report

9.1 Report the following information:
9.1.1 The identity of the material,
9.1.2 The nominal thickness of the pasted mica,
9.1.3 The observed values of T and T',
9.1.4 The percentage compressive creep, and
9.1.5 The specimen temperature.

10. Precision and Bias

10.1 This method has been in use for many years but no statement for precision has been made and no activity is planned to develop such a statement.

10.2 A statement of bias is not possible due to a lack of a standard reference material.

STABILITY UNDER HEAT AND PRESSURE

11. Scope

11.1 The test for stability under heat and pressure determines mica or binder displacement, or both, under the specified conditions of test.

12. Significance and Use

12.1 This test serves as a measure of the ability of bonded micaceous materials to maintain their physical integrity under exposure to heat and pressure. It has special significance where the material to be tested is employed as commutator segment insulation. This test is suitable for acceptance tests and for manufacturing control.