



Standard Test Method for Enthalpies of Fusion and Crystallization of Polymers by Differential Scanning Calorimetry (DSC)¹

This standard is issued under the fixed designation D 3417; 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 covers the determination of heat of fusion and heat of crystallization of polymers by differential scanning calorimetry.

1.2 This test method is applicable to polymers in granular form (below 60 mesh preferred, avoid grinding if possible) or to any fabricated shape from which appropriate specimens can be cut.

1.3 The normal operating temperature range is from the cryogenic region to 600°C.

1.4 The values in SI units are to be regarded as the standard.

NOTE 1—True heats of fusion can only be determined in conjunction with structure investigation, and frequently, specialized crystallization techniques are needed.

NOTE 2—This test method may be used in conjunction with Test Method D 3418 or E 794 to simultaneously determine the temperatures of melting and crystallization.

NOTE 3—This test method may not be applicable to all types of polymers as written (see 6.6).

NOTE 4—Uncertain radiation losses at temperatures higher than 400°C may affect the accuracy of results.

1.5 *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.*

NOTE 5—The test method is similar but not equivalent to ISO 11357-1 and 11357-3. The ISO standard provides additional information not supplied by this test method.

2. Referenced Documents

2.1 ASTM Standards:

D 3418 Test Method for Transition Temperatures of Polymers by Thermal Analysis²

E 473 Terminology Relating to Thermal Analysis³

E 793 Test Method for Heats of Fusion and Crystallization by Differential Scanning Calorimetry³

E 794 Test Method for Melting and Crystallization Temperatures by Thermal Analysis³

E 968 Practice for Heat Flow Calibration of Differential Scanning Calorimeters³

E 1142 Terminology Relating to Thermophysical Properties³

2.2 ISO Standards:⁴

11357-1 Plastics—Differential Scanning Calorimetry (DSC)—Part 1: General Principles

11357-3 Plastics—Differential Scanning Calorimetry (DSC)—Part 3: Determination of Temperature and Enthalpy of Melting and Crystallization

3. Terminology

3.1 Specialized terms used in this test method are defined in Terminologies E 473 and E 1142.

4. Summary of Test Method

4.1 This test method consists of heating or cooling the test material at a controlled rate in a specified purge gas at a controlled flow rate and comparing the areas under the crystallization exotherm or fusion endotherm of the test material against the respective areas obtained by the similar treatment of a well-characterized standard.

5. Significance and Use

5.1 Differential scanning calorimetry provides a rapid method for determining enthalpy changes accompanied by the first-order transitions of materials. The heat of fusion, the heat of crystallization, and also the effect of annealing can be determined in polymers that possess them. Differential scanning calorimetry may be used to assist in identifying specific polymers, polymer alloys, and certain polymer additives that exhibit thermal transitions.

¹ This test method is under the jurisdiction of ASTM Committee D-20 on Plastics and is the direct responsibility of Subcommittee D20.30 on Thermal Properties (Section D20.30.07).

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² *Annual Book of ASTM Standards*, Vol 08.02.

³ *Annual Book of ASTM Standards*, Vol 14.02.

⁴ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.