



Designation: E 793 – 95

Standard Test Method for Enthalpies of Fusion and Crystallization by Differential Scanning Calorimetry¹

This standard is issued under the fixed designation E 793; 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 the enthalpy (heat) of fusion (melting) and crystallization by differential scanning calorimetry (DSC).

1.2 This test method is applicable to solid samples in granular form or in any fabricated shape from which an appropriate specimen can be cut, or to liquid samples that crystallize within the range of the instrument. Note, however, that the results may be affected by the form and mass of the specimen, as well as by other experimental conditions.

1.3 The normal operating temperature range is from –120 to 600°C. The temperature range can be extended depending upon the instrumentation used.

1.4 This test method is generally applicable to thermally stable materials with well defined endothermic or exothermic behavior.

1.5 Computer or electronic based instruments, techniques, or data treatment equivalent to those in this test method may also be used.

1.6 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.7 *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.*

2. Referenced Documents

2.1 ASTM Standards:

E 473 Terminology Relating to Thermal Analysis²

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

E 968 Practice for Heat Flow Calibration of Differential Scanning Calorimeters³

¹ This test method is under the jurisdiction of ASTM Committee E-37 on Thermal Measurements and is the direct responsibility of Subcommittee E 37.01 on Test Methods and Recommended Practices.

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² Annual Book of ASTM Standards, Vol 14.02.

³ Supporting data for this test method have been filed as ASTM Headquarters. Request RR:E37-1001.

E 1142 Terminology Relating to Thermophysical Properties²

3. Terminology

3.1 *Definitions*—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 involves heating (or cooling) a test specimen at a controlled rate in a controlled environment through the temperature region of fusion or crystallization. The heat flow associated with fusion, an endothermic process (and crystallization, an exothermic process), is recorded and integrated over time. Absolute values for the enthalpy of fusion (and enthalpy of crystallization) or relative values for comparative purposes can thus be obtained.

NOTE 1—Melting (or crystallization) temperatures are sometimes determined in conjunction with measurements of the enthalpy of fusion or crystallization. These temperature values may be obtained by Test Method E 794.

5. Significance and Use

5.1 Differential scanning calorimetry provides a rapid method for the determination of enthalpic changes accompanying first-order transitions of materials.

5.2 This test method is useful for quality control, specification acceptance, and research.

6. Apparatus

6.1 *Differential Scanning Calorimeter*, capable of heating or cooling rates up to at least 10°C/min and of automatically recording the differential heat flow between a specimen and a reference material, both to the required sensitivity and precision. For comparison, the same heating rate shall be used for all calibrations and test runs. Thermal curves are recorded on a time based recorder for peak area measurements. The instruments should have sufficient heat flow sensitivity to provide precision of $\pm 1\%$. The instrument shall have a time base precision of $\pm 1\%$ over the time base range from 0.1 to 2.0 min/cm (10.0 to 0.5 cm/min) of chart. Some instrument models allow computer acquisition of heat flow data which may be plotted.

6.2 *Planimeter*, or other method of area measurement with