



Standard Test Methods for the Assignment of the Glass Transition Temperature by Modulated Temperature Differential Scanning Calorimetry¹

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1. Scope

1.1 These test methods describe the assignment of the glass transition temperature of materials using modulated temperature differential scanning calorimetry (MTDSC) over the temperature range from -120 to $+600^{\circ}\text{C}$. The temperature range may be extended depending upon the instrumentation used.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 There are no ISO equivalents to this 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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*²

E473 Terminology Relating to Thermal Analysis and Rheology

E967 Test Method for Temperature Calibration of Differential Scanning Calorimeters and Differential Thermal Analyzers

E968 Practice for Heat Flow Calibration of Differential Scanning Calorimeters

E1142 Terminology Relating to Thermophysical Properties

E1356 Test Method for Assignment of the Glass Transition Temperatures by Differential Scanning Calorimetry

E1545 Test Method for Assignment of the Glass Transition Temperature by Thermomechanical Analysis

¹ These test methods are under the jurisdiction of ASTM Committee E37 on Thermal Measurements and is the direct responsibility of Subcommittee E37.01 on Calorimetry and Mass Loss.

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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.

E1640 Test Method for Assignment of the Glass Transition Temperature By Dynamic Mechanical Analysis

3. Terminology

3.1 *Definitions*—Specific technical terms found in these test methods are defined in Terminologies E473 and E1142 including *differential scanning calorimetry*, *glass transition*, *glass transition temperature*, *specific heat capacity*, and *thermal curve*.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *extrapolated end temperature (T_e)*, n —the point of intersection of the tangent drawn at the point of greatest slope (that is, the inflection point) in the transition region with the extrapolated baseline following the transition.

3.2.2 *extrapolated onset temperature (T_f)*, n —the point of intersection of the tangent drawn at the point of greatest slope (that is, the inflection point) in the transition region with the extrapolated baseline prior to the transition.

3.2.3 *midpoint temperature (T_m)*, n —the point on the thermal curve corresponding to the average of the extrapolated onset and extrapolated end temperatures.

3.2.4 *modulated*, n —a prefix indicating that a parameter changes in a periodic manner during the experiment.

3.2.5 *modulated heat flow*, n —the heat flow resulting from an applied modulated temperature program.

3.2.6 *modulated temperature differential scanning calorimetry (MTDSC)*, n —a method of differential scanning calorimetry (DSC) that varies the temperature sinusoidally or with a periodic step-and-hold or pulse program to the test specimen over a traditional isothermal or temperature ramp program. Results from the experiment include reversing and nonreversing heat flow and specimen temperature.

3.2.7 *nonreversing heat flow*, n —the kinetic component of the total heat flow. That is, the portion of the heat flow that responds to temperature and not to the temperature rate of change.

3.2.8 *reversing heat flow*, n —the portion of the total heat flow that responds to the temperature rate of change.

3.2.9 *total heat flow*, n —the value of the modulated heat flow averaged over one modulation period or impulse.