



Standard Test Method for Kinetic Parameters by Differential Scanning Calorimetry Using Isothermal Methods¹

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1. Scope

1.1 Test Method A determines kinetic parameters for activation energy, pre-exponential factor and reaction order using differential scanning calorimetry from a series of isothermal experiments over a small (~ 10 K) temperature range. This treatment is applicable to low n th order reactions and to autocatalyzed reactions such as thermoset curing or pyrotechnic reactions and crystallization transformations in the temperature range from 300 to 900 K (30 to 630 °C). This test method is applicable only to these types of exothermic reactions when the thermal curves do not exhibit shoulders, discontinuities or shifts in baseline.

1.2 Test Method B also determines the activation energy of a set of time-to-event and isothermal temperature data generated by this or other procedures.

1.3 Electronic instrumentation or automated data analysis systems or treatments equivalent to this test method may be used.

NOTE 1—Since all electronic data systems are not equivalent, the user must verify the applicability of the treatment to this method.

1.4 SI units are the standard.

1.5 This test method is similar but not equivalent to ISO 11357, Part 5, and provides more information than the ISO standard.

1.6 *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.* Specific precautionary statements are given in Section 8.

2. Referenced Documents

2.1 ASTM Standards:

D 3350 Specification for Polyethylene Plastic Pipe²

D 3895 Test Method for Oxidative Induction Time of Polyolefins by Differential Scanning Calorimetry²

D 4565 Test Method for Physical and Environmental Performance Properties of Insulations and Jackets for Telecommunications Wire and Cable³

D 5483 Test Method for Oxidation Induction Time of Lubricating Greases by Pressure Differential Scanning Calorimetry⁴

D 6186 Test Method for Oxidation Induction Time of Lubricating Oils by Pressure Differential Scanning Calorimetry⁴

E 473 Terminology Relating to Thermal Analysis⁵

E 537 Test Method for Assessing the Thermal Stability of Chemicals by Method of Differential Thermal Analysis⁵

E 698 Test Method for Arrhenius Kinetic Constants for Thermally Unstable Materials⁵

E 967 Test Method for Temperature Calibration of Differential Thermal Analyzers and Differential Scanning Calorimeters⁵

E 968 Test Method for Heat Flow Calibration of Differential Scanning Calorimeters⁵

E 1142 Terminology Relating to Thermophysical Properties⁵

E 1445 Terminology Relating to Hazardous Properties of Materials⁵

E 1860 Test Method for Elapsed Time Calibration of Thermal Analyzers⁵

E 1958 Test Method for Oxidative Induction Time of Hydrocarbons by Differential Scanning Calorimetry⁵

E 1970 Practice for Statistical Treatment of Thermoanalytical Data⁵

E 2041 Test Method for Kinetic Parameters by the Borchardt and Daniels Method using Differential Scanning Calorimetry⁵

E 2046 Test Method for Reaction Induction Time by Thermal Analysis⁵

2.2 ISO Standard:

ISO DIS 11357 Part 5 Determination of Temperature and/or Time of Reaction and Reaction Kinetics⁶

¹ This test method is under the jurisdiction of ASTM Committee E37 on Thermal Measurements and is the direct responsibility of Subcommittee E37.01 on Thermal Analysis Test Methods.

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² Annual Book of ASTM Standards, Vol 08.02.

³ Annual Book of ASTM Standards, Vol 10.02.

⁴ Annual Book of ASTM Standards, Vol 05.03.

⁵ Annual Book of ASTM Standards, Vol 14.02.

⁶ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.