



Designation: E 537 – 98

# Standard Test Method for Assessing The Thermal Stability Of Chemicals By Methods Of Thermal Analysis<sup>1</sup>

This standard is issued under the fixed designation E 537; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## INTRODUCTION

Committee E-27 is currently engaged in developing methods to determine the hazard potential of chemicals. An estimate of this potential may usually be obtained by the use of program CHETAH 7.0 to compute the maximum energy of reaction of the chemical or mixture of chemicals.<sup>2</sup>

The expression “hazard potential” as used by this committee is defined as the degree of susceptibility of material to ignition or release of energy under varying environmental conditions.

The primary purpose of this test method is to detect enthalpic changes and to approximate the temperature of initiation of these events. Thermal analysis techniques including differential thermal analysis (DTA) and differential scanning calorimetry (DSC) offer the advantage of using very small samples on the order of a few milligrams.

## 1. Scope

1.1 This test method covers the ascertainment of the presence of enthalpic changes, using a minimum quantity of sample, normally in the milligram range, and approximates the temperature at which these enthalpic changes occur.

1.2 This test method utilizes techniques of differential thermal analysis (DTA) and differential scanning calorimetry (DSC); it may be performed on solids, liquids, or slurries.

1.3 This test method may be carried out in an inert or a reactive atmosphere with an absolute pressure range from 100 Pa through 7 MPa and over a temperature range from  $-150^{\circ}\text{C}$  to above  $1000^{\circ}\text{C}$ .

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

1.5 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety concerns 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 safety precautions are given in Section 8.*

## 2. Referenced Documents

### 2.1 ASTM Standards:

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee E-27 on Hazard Potential of Chemicals and is the direct responsibility of Subcommittee E27.02 on Thermal Stability.

Current edition approved July 10, 1998. Published December 1998. Originally published as E 537 – 76. Last previous edition E 537 – 86 (1992).

<sup>2</sup> A complete assessment of the hazard potential of chemicals must take into account a number of realistic factors not considered in this test method or the CHETAH program.

E 473 Terminology Relating to Thermal Analysis<sup>3</sup>

E 967 Practice for Temperature Calibration of Differential Scanning Calorimeters and Differential Thermal Analyzers<sup>3</sup>

E 1445 Terminology Relating to Hazardous Potential of Chemicals<sup>3</sup>

E 1860 Test Method for Elapsed Time Calibration of Thermal Analyzers<sup>3</sup>

## 3. Terminology

### 3.1 Definitions:

3.1.1 Specific technical terms used in this standard are defined in Terminologies E 473 and E 1445.

### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *DTA (DSC) curve*—a record of a thermal analysis where the temperature difference ( $\Delta T$ ) or the change in heat flow ( $\Delta q$ ) is plotted on the ordinate and temperature or time is plotted on the abscissa (see Figs. 1 and 2 and Terminology E 473).

3.2.2 *peak*—that portion of a heating curve which is attributable to the occurrence of a single process. It is normally characterized by a deviation from the established baseline, a maximum deflection, and a reestablishment of a baseline not necessarily identical to that before the peak (see Fig. 1).

NOTE 1—There will be instances when upon scanning in temperature an endotherm will be observed that is immediately followed by or is in conjunction with an exotherm as shown in Fig. 2. These types of competing reactions make it difficult and at times impossible to locate the true peak and onset temperatures.

3.2.3 *peak temperature*—the temperature corresponding to

<sup>3</sup> Annual Book of ASTM Standards, Vol 14.02.

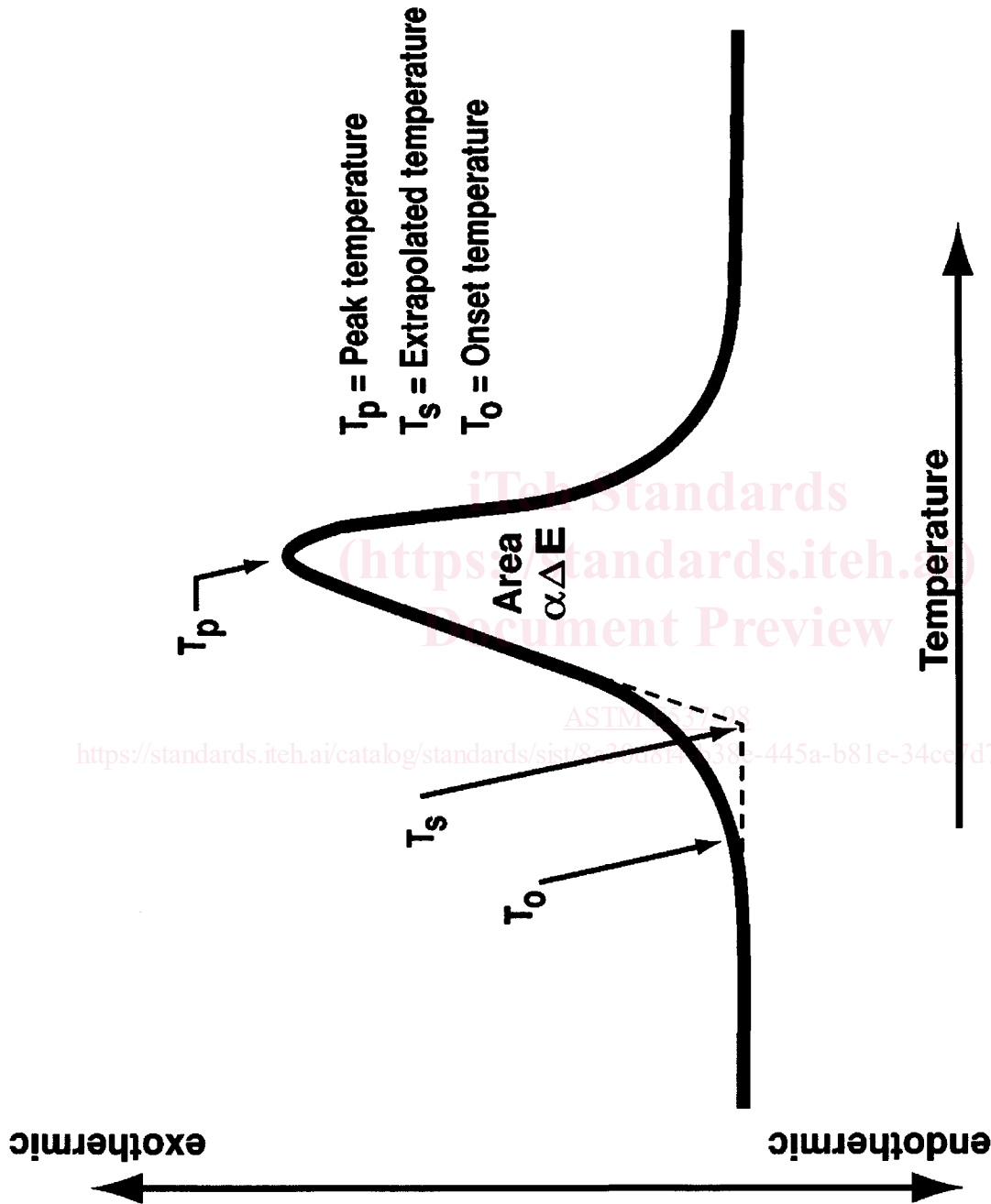


FIG. 1 Typical DTA—DSC Curve with Exotherm

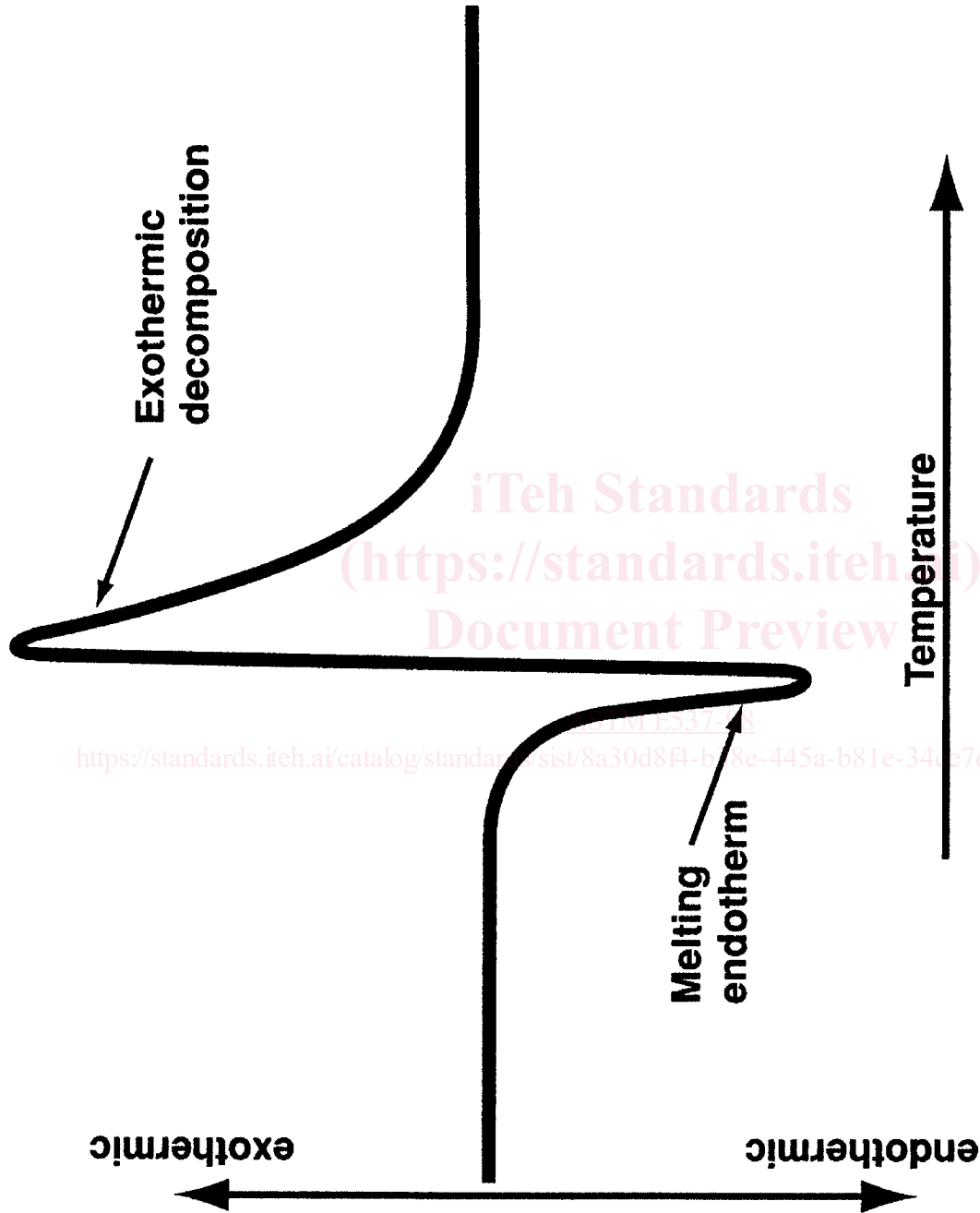


FIG. 2 Thermogram Illustrating a Melting Process Immediately Followed by an Exothermic Decomposition

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ASTM E537-98  
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