



Designation: E831 – 19

Standard Test Method for Linear Thermal Expansion of Solid Materials by Thermomechanical Analysis¹

This standard is issued under the fixed designation E831; 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 determines the technical coefficient of linear thermal expansion of solid materials using thermomechanical analysis techniques.

1.2 This test method is applicable to solid materials that exhibit sufficient rigidity over the test temperature range such that the sensing probe does not produce indentation of the specimen.

1.3 The recommended lower limit of coefficient of linear thermal expansion measured with this test method is 5 $\mu\text{m}/(\text{m}\cdot^\circ\text{C})$. The test method may be used at lower (or negative) expansion levels with decreased accuracy and precision (see Section 11).

1.4 This test method is applicable to the temperature range from -120°C to 900°C . The temperature range may be extended depending upon the instrumentation and calibration materials used.

1.5 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

¹ This test method is under the jurisdiction of ASTM Committee E37 on Thermal Measurements and is the direct responsibility of Subcommittee E37.10 on Fundamental, Statistical and Mechanical Properties.

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2. Referenced Documents

2.1 ASTM Standards:²

D696 Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C with a Vitreous Silica Dilatometer

D3386 Test Method for Coefficient of Linear Thermal Expansion of Electrical Insulating Materials (Withdrawn 2005)³

E228 Test Method for Linear Thermal Expansion of Solid Materials With a Push-Rod Dilatometer

E473 Terminology Relating to Thermal Analysis and Rheology

E1142 Terminology Relating to Thermophysical Properties

E1363 Test Method for Temperature Calibration of Thermomechanical Analyzers

E2113 Test Method for Length Change Calibration of Thermomechanical Analyzers

3. Terminology

3.1 *Definitions*—Thermal analysis terms in Terminologies **E473** and **E1142** shall apply to this test method, including *coefficient of linear thermal expansion*, *thermodilatometry*, and *thermomechanical analysis*.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *mean coefficient of linear thermal expansion*, (α_m), n —the change in length, relative to the specimen length at ambient temperature, accompanying a unit change in temperature identified by the midpoint temperature of the temperature range of measurement.

4. Summary of Test Method

4.1 This test method uses a thermomechanical analyzer or similar device to determine the linear thermal expansion of solid materials when subjected to a constant heating rate.

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.

³ The last approved version of this historical standard is referenced on www.astm.org.