



Designation: E 2113 – 00

Standard Test Method for Length Change Calibration of Thermomechanical Analyzers¹

This standard is issued under the fixed designation E 2113; 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 method describes calibration of the length change (deflection) measurement or thermal expansion of thermomechanical analyzers (TMA) over the temperature range from -100 to 600°C using the thermal expansion of a suitable reference material.

1.2 Computer or electronic based instruments, techniques or data treatment equivalent to this method may be used.

NOTE 1—Users are advised that all such instruments or techniques may not be equivalent. It is the responsibility of the user to determine necessary equivalency prior to use.

1.3 SI values are the standard.

1.4 This method differs from ISO standard 11359-1 by providing an alternative calibration procedure.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of whoever uses this standard to consult and 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 831 Test Method for Linear Thermal Expansion of Solid Materials by Thermomechanical Analysis²

E 1142 Terminology Relating to Thermophysical Properties²

E 1363 Test Method for Temperature Calibration of Thermomechanical Analyzers²

2.2 Other Standards:

ISO 11359-1 Plastics—Thermomechanical analysis (TMA)—Part 1: General principles³

3. Terminology

3.1 Specific technical terms used in this method are described in Terminologies E 473 and E 1142.

4. Summary of Test Method

4.1 Thermomechanical analyzers (TMAs) or related devices are commonly used to determine coefficient of linear thermal expansion of solid materials (e.g., method E 831). The test specimen is heated at a linear rate over the temperature range of interest and the change in length (dimension) is electronically recorded.

4.2 Performance verification or calibration of the length change measurement is needed to obtain accurate coefficient of thermal expansion data.

4.3 The thermal expansion of a reference material is recorded using a thermomechanical analyzer. The recorded thermal expansion is compared to the known value of the reference material. The resultant ratio, a calibration coefficient, may then be applied to the determination of unknown specimens to obtain accurate results.

5. Significance and Use

5.1 Performance verification or calibration is essential to the accurate determination of quantitative dimension change measurements.

5.2 This method may be used for instrument performance validation, regulatory compliance, research, and development and quality assurance purposes.

6. Apparatus

6.1 *Thermomechanical Analyzer (TMA)*— The essential instrumentation required to provide the minimum thermomechanical analytical or thermodilatometric capability for this method includes:

6.1.1 A rigid specimen holder of inert, low expansivity material [$<0.5 \mu\text{m} / (\text{m} \cdot \text{K})$] to center the specimen in the furnace and to fix the specimen to mechanical ground.

6.1.2 A rigid expansion probe of inert, low expansivity material [$<0.5 \mu\text{m}/(\text{m} \cdot \text{K})$] which contacts the specimen with an applicable compressive or tensile force.

6.1.3 A sensing element, linear over a minimum of 2 mm, to measure the displacement of the rigid probe to within $\pm 10 \text{ nm}$ resulting from changes in length/height of the specimen.

6.1.4 A weight or force transducer to generate a constant force between 1 and 100 mN (0.1 and 10 g) applied through the rigid probe to the specimen.

6.1.5 A furnace capable of providing uniform controlled

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. Current edition approved Nov. 10, 2000. Published April 2001.

² *Annual Book of ASTM Standards*, Vol 14.02.

³ Available from American National Standards Institute, 11 W 42nd Street, 13th Floor, New York, NY 10036.