



Designation: E2254 – 11

Standard Test Method for Storage Modulus Calibration of Dynamic Mechanical Analyzers¹

This standard is issued under the fixed designation E2254; 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 describes the calibration or performance confirmation for the storage modulus scale of a commercial or custom built dynamic mechanical analyzer (DMA) over the temperature range of -100 to 300 °C using reference materials in the range of 1 to 200 GPa.

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 *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

E698 Test Method for Arrhenius Kinetic Constants for Thermally Unstable Materials Using Differential Scanning Calorimetry and the Flynn/Wall/Ozawa Method

E1142 Terminology Relating to Thermophysical Properties

E2425 Test Method for Loss Modulus Conformance of Dynamic Mechanical Analyzers

D638 Test Method for Tensile Properties of Plastics

3. Terminology

3.1 *Definitions*—Specific technical terms used in this test method are defined in Terminologies E473 and E1142 including *Celsius*, *dynamic mechanical analysis*, and *storage modulus*.

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 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.

4. Summary of Test Method

4.1 The storage modulus signal determined by a dynamic mechanical analyzer for an elastic reference material is compared to the reported storage modulus for that reference material. A linear relationship is used to correlate the experimental storage modulus signal with the reported value of the reference material.

4.2 The mode of deformation (for example, tensile, flexure, compression, etc.) shall be reported.

5. Significance and Use

5.1 This test method calibrates or demonstrates conformity of a dynamic mechanical analyzer at an isothermal temperature within the range of -100 to 300 °C.

5.2 Dynamic mechanical analysis experiments often use temperature ramps. This method does not address the effect of that change in temperature on the storage modulus.

5.3 A calibration factor may be required to obtain corrected storage modulus values.

5.4 This method may be used in research and development, specification acceptance, and quality control or assurance.

6. Apparatus

6.1 The essential instrumentation required to provide the minimum dynamic mechanical capability for this test method includes:

6.1.1 *Drive Motor*; to apply force (or displacement) to the specimen in a periodic manner. This motor may also be capable of providing static force or displacement on the specimen.

6.1.2 *Coupling Shaft*, or other means to transmit the force from the motor to the specimen.

6.1.3 *Clamping System(s)*, to fix the specimen between the drive shaft and the stationary clamp(s).

6.1.4 *Position Sensor*; to measure the change in position of the specimen during dynamic motion, or,

6.1.5 *Force Sensor*; to measure the force applied to the specimen.

6.1.6 *Temperature Sensor*; to provide an indication of the specimen temperature to ± 1 °C.