



Standard Test Method for Dynamic Young's Modulus, Shear Modulus, and Poisson's Ratio for Advanced Ceramics by Impulse Excitation of Vibration¹

This standard is issued under the fixed designation C 1259; 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 covers determination of the dynamic elastic properties of advanced ceramics at ambient temperatures. Specimens of these materials possess specific mechanical resonant frequencies that are determined by the elastic modulus, mass, and geometry of the test specimen. The dynamic elastic properties of a material can therefore be computed if the geometry, mass, and mechanical resonant frequencies of a suitable (rectangular or cylindrical geometry) test specimen of that material can be measured. Dynamic Young's modulus is determined using the resonant frequency in the flexural mode of vibration. The dynamic shear modulus, or modulus of rigidity, is found using torsional resonant vibrations. Dynamic Young's modulus and dynamic shear modulus are used to compute Poisson's ratio.

1.2 Although not specifically described herein, this test method can also be performed at cryogenic and high temperatures with suitable equipment modifications and appropriate modifications to the calculations to compensate for thermal expansion.

1.3 Where possible, the procedures, sample specifications, and calculations in this test method are consistent with Test Methods C 623, C 747, C 848, and C 1198.

1.4 This test method uses test specimens in bar, rod, and disc geometries. The rod and bar geometries are described in the main body. The disc geometry is addressed in Annex A1.

1.5 The values stated in SI units are to be regarded as the 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.*

2. Referenced Documents

2.1 ASTM Standards:

C 372 Test Method for Linear Thermal Expansion of Por-

celain Enamel and Glaze Frits and Fired Ceramic Whiteware Products by the Dilatometer Method²

C 623 Test Method for Young's Modulus, Shear Modulus, and Poisson's Ratio for Glass and Glass-Ceramics by Resonance²

C 747 Test Method for Moduli of Elasticity and Fundamental Frequencies of Carbon and Graphite Materials by Sonic Resonance³

C 848 Test Method for Young's Modulus, Shear Modulus, and Poisson's Ratio for Ceramic Whitewares by Resonance²

C 1145 Terminology of Advanced Ceramics³

C 1161 Test Method for Flexural Strength of Advanced Ceramics at Ambient Temperature³

C 1198 Test Method for Dynamic Young's Modulus, Shear Modulus, and Poisson's Ratio for Advanced Ceramics by Sonic Resonance³

D 4092 Terminology Relating to Dynamic Mechanical Measurements on Plastics⁴

E 6 Terminology Relating to Methods of Mechanical Testing⁵

E 177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods³

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method⁶

3. Terminology

3.1 *Definitions*—The definitions of terms relating to mechanical testing appearing in Terminology E 6 should be considered as applying to the terms used in this test method. The definitions of terms relating to advanced ceramics appearing in Terminology C 1145 should be considered as applying to the terms used in this test method. Directly pertinent definitions as listed in Terminologies E 6, C 1145, and D 4092 are shown in the following paragraphs with the appropriate source given in brackets.

3.1.1 *advanced ceramic, n*—a highly engineered, high-performance, predominately nonmetallic, inorganic, ceramic

¹ This test method is under the jurisdiction of ASTM Committee C28 on Advanced Ceramics and is the direct responsibility of Subcommittee C28.01 on Properties and Performance.

Current edition approved April 10, 2001. Published June 2001. Originally published as C 1259–94. Last previous edition C 1259–98.

² *Annual Book of ASTM Standards*, Vol 15.02.

³ *Annual Book of ASTM Standards*, Vol 15.01.

⁴ *Annual Book of ASTM Standards*, Vol 08.02.

⁵ *Annual Book of ASTM Standards*, Vol 03.01.

⁶ *Annual Book of ASTM Standards*, Vol 14.02.