



Standard Practice for Constant-Amplitude, Axial, Tension-Tension Cyclic Fatigue of Continuous Fiber-Reinforced Advanced Ceramics at Ambient Temperatures¹

This standard is issued under the fixed designation C 1360; 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 practice covers the determination of constant-amplitude, axial tension-tension cyclic fatigue behavior and performance of continuous fiber-reinforced advanced ceramic composites (CFCCs) at ambient temperatures. This practice builds on experience and existing standards in tensile testing CFCCs at ambient temperatures and addresses various suggested test specimen geometries, specimen fabrication methods, testing modes (load, displacement, or strain control), testing rates and frequencies, allowable bending, and procedures for data collection and reporting. This practice does not apply to axial cyclic fatigue tests of components or parts (that is, machine elements with nonuniform or multiaxial stress states).

1.2 This practice applies primarily to advanced ceramic matrix composites with continuous fiber reinforcement: uni-directional (1-D), bi-directional (2-D), and tri-directional (3-D) or other multi-directional reinforcements. In addition, this practice may also be used with glass (amorphous) matrix composites with 1-D, 2-D, 3-D, and other multi-directional continuous fiber reinforcements. This practice does not directly address discontinuous fiber-reinforced, whisker-reinforced or particulate-reinforced ceramics, although the methods detailed here may be equally applicable to these composites.

1.3 The values stated in SI units are to be regarded as the standard and are in accordance with Practice E 380.

1.4 *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.* Refer to Section 7 for specific precautions.

2. Referenced Documents

2.1 ASTM Standards:

C 1145 Terminology of Advanced Ceramics²

C 1275 Test Method for Monotonic Tensile Strength Testing of Continuous Fiber-Reinforced Advanced Ceramics

with Solid Rectangular Cross-Section Specimens at Ambient Temperatures²

D 3479 Test Methods for Tension-Tension Fatigue of Oriented Fiber, Resin Matrix Composites³

D 3878 Terminology of High Modulus Reinforcing Fibers and Their Composites³

E 4 Practices for Force Verification of Testing Machines⁴

E 6 Terminology Relating to Methods of Mechanical Testing⁴

E 83 Practice for Verification and Classification of Extensometers⁴

E 337 Test Method for Measured Humidity with Psychrometer (Measurement of Wet-and Dry-Bulb Temperatures)⁵

E 380 Practice for Use of International System of Units (SI) (the Modernized Metric System)⁶

E 467 Practice for Verification of Constant Amplitude Dynamic Loads in an Axial Load Fatigue Testing Machine⁶

E 468 Practice for Presentation of Constant Amplitude Fatigue Test Results for Metallic Materials⁶

E 739 Practice for Statistical Analysis of Linear or Linearized Stress-Life (S-N) and Strain-Life (ϵ -N) Fatigue Data⁶

E 1012 Practice for Verification of Specimen Alignment Under Tensile Loading⁴

E 1150 Terminology Relating to Fatigue⁴

3. Terminology

3.1 Definitions:

3.1.1 Definitions of terms relating to advanced ceramics, fiber-reinforced composites, tensile testing, and cyclic fatigue as they appear in Terminology C 1145, Terminology D 3878, Terminology E 6, and Terminology E 1150, respectively, apply to the terms used in this practice. Selected terms with definitions follow with the appropriate source given in parentheses. Additional terms are also defined in 3.2.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *advanced ceramic, n*—A highly engineered, high performance predominately non-metallic, inorganic, ceramic material having specific functional attributes. (See Terminology C 1145.)

¹ This practice is under the jurisdiction of ASTM Committee C-28 on Advanced Ceramics and is the direct responsibility of Subcommittee C28.07 on Ceramic Matrix Composites.

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² *Annual Book of ASTM Standards*, Vol 15.01.

³ *Annual Book of ASTM Standards*, Vol 15.03.

⁴ *Annual Book of ASTM Standards*, Vol 03.01.

⁵ *Annual Book of ASTM Standards*, Vol 07.02.

⁶ *Annual Book of ASTM Standards*, Vol 14.01.