



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

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1. Scope*

1.1 This practice covers the determination of constant-amplitude, axial tension-tension cyclic fatigue behavior and performance of advanced ceramics at ambient temperatures to establish “baseline” cyclic fatigue performance. This practice builds on experience and existing standards in tensile testing advanced ceramics at ambient temperatures and addresses various suggested test specimen geometries, test specimen fabrication methods, testing modes (force, 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 non uniform or multiaxial stress states).

1.2 This practice applies primarily to advanced ceramics that macroscopically exhibit isotropic, homogeneous, continuous behaviour. While this practice applies primarily to monolithic advanced ceramics, certain whisker- or particle-reinforced composite ceramics as well as certain discontinuous fibre-reinforced composite ceramics may also meet these macroscopic behaviour assumptions. Generally, continuous fibre-reinforced ceramic composites (CFCCs) do not macroscopically exhibit isotropic, homogeneous, continuous behaviour and application of this practice to these materials is not recommended.

1.3 The values stated in SI units are to be regarded as the standard and are in accordance with [IEEE/ASTM SI 10](#).

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.*

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

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2. Referenced Documents

2.1 ASTM Standards:²

- C1145 Terminology of Advanced Ceramics
- C1273 Test Method for Tensile Strength of Monolithic Advanced Ceramics at Ambient Temperatures
- C1322 Practice for Fractography and Characterization of Fracture Origins in Advanced Ceramics
- E4 Practices for Force Verification of Testing Machines
- E6 Terminology Relating to Methods of Mechanical Testing
- E83 Practice for Verification and Classification of Extensometer Systems
- E337 Test Method for Measuring Humidity with a Psychrometer (the Measurement of Wet- and Dry-Bulb Temperatures)
- E467 Practice for Verification of Constant Amplitude Dynamic Forces in an Axial Fatigue Testing System
- E468 Practice for Presentation of Constant Amplitude Fatigue Test Results for Metallic Materials
- E739 Practice for Statistical Analysis of Linear or Linearized Stress-Life ($S-N$) and Strain-Life ($\epsilon-N$) Fatigue Data
- E1012 Practice for Verification of Testing Frame and Specimen Alignment Under Tensile and Compressive Axial Force Application
- E1823 Terminology Relating to Fatigue and Fracture Testing
- IEEE/ASTM SI 10 Standard for Use of the International System of Units (SI) (The Modern Metric System)

2.2 Military Handbook:

- MIL-HDBK-790 Fractography and Characterization of Fracture Origins in Advanced Structural Ceramics³

3. Terminology

3.1 *Definitions*—Definitions of terms relating to advanced ceramics, cyclic fatigue, and tensile testing as they appear in Terminology C1145, Terminology E1823, and Terminology E6, respectively, apply to the terms used in this practice. Selected terms with definitions non-specific to this practice

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 Available from Army Research Laboratory-Materials Directorate, Aberdeen Proving Ground, MD 21005.