



Standard Test Method for Determination of Slow Crack Growth Parameters of Advanced Ceramics by Constant Stress-Rate Flexural Testing at Ambient Temperature¹

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1. Scope

1.1 This test method covers the determination of slow crack growth (SCG) parameters of advanced ceramics by using constant stress-rate flexural testing in which flexural strength is determined as a function of applied stress rate in a given environment at ambient temperature. The strength degradation exhibited with decreasing applied stress rate in a specified environment is the basis of this test method which enables the evaluation of slow crack growth parameters of a material.

NOTE 1—This test method is frequently referred to as “dynamic fatigue” testing (Refs (1-3)²) in which the term “fatigue” is used interchangeably with the term “slow crack growth.” To avoid possible confusion with the “fatigue” phenomenon of a material which occurs exclusively under cyclic loading, as defined in Definitions E 1150, this test method uses the term “constant stress-rate testing” rather than “dynamic fatigue” testing.

NOTE 2—In glass and ceramics technology, static tests of considerable duration are called “static fatigue” tests, a type of test designated as stress-rupture (See Definitions E 1150).

1.2 Values expressed in this test method are in accordance with the International System of Units (SI) and Practice E 380.

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:

- C 1145 Terminology of Advanced Ceramics
- C 1161 Test Method for Flexural Strength of Advanced Ceramics at Ambient Temperature³
- C 1239 Practice for Reporting Uniaxial Strength Data and Estimating Weibull Distribution Parameters for Advanced Ceramics³

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.

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² The boldface numbers in parentheses refer to the list of references at the end of this standard.

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

C 1322 Practice for Fractography and Characterization of Fracture Origins in Advanced Ceramics³

E 4 Practices for Force Verification of Testing Machines⁴

E 6 Terminology Relating to Methods of Mechanical Testing⁴

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

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

E 1823 Terminology Relating to Fatigue and Fracture Testing⁴

2.2 Military Handbook:

MIL-HDBK-790 Fractography and Characterization of Fracture Origins in Advanced Structural Ceramics⁷

3. Terminology

3.1 *Definitions*—The terms described in Terminology C 1145, Terminology E 6, Terminology E 616, and Definitions E 1150 are applicable to this test method. Specific terms relevant to this test method are as follows:

3.1.1 *advanced ceramic, n*—a highly engineered, high-performance, predominately nonmetallic, inorganic, ceramic material having specific functional attributes. **(C 1145)**

3.1.2 *constant stress rate, $\dot{\sigma}$, n*—a constant rate of maximum stress applied to a specified beam by using either a constant loading or constant displacement rate of a testing machine.

3.1.3 *environment, n*—the aggregate of chemical species and energy that surrounds a test specimen. **(E 1150)**

3.1.4 *environmental chamber, n*—the container of bulk volume surrounding a test specimen. **(E 1150)**

3.1.5 *flexural strength, σ_f , n*—a measure of the strength of a specified beam specimen in bending determined at a given stress rate in a particular environment.

3.1.6 *flexural strength-stress rate curve, n*—a curve fitted to the values of flexural strength at each of several stress rates, based on the relationship between flexural strength and stress rate: $\log \sigma_f = 1/(n + 1) \log \dot{\sigma} + \log D$. (See Appendix X1.)

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

⁵ *Annual Book of ASTM Standards*, Vol 11.03.

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

⁷ Available from Army Research Laboratory—Materials Directorate, Aberdeen Proving Ground, MD 21005.