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Standard Test Method for Flexural Strength of Advanced Ceramics at Ambient Temperature[1]

This standard is issued under the fixed designation C 1161; 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 the determination of flexural strength of advanced ceramic materials at ambient temperature. Four-point–¼ point and three-point loadings with prescribed spans are the standard. Rectangular specimens of prescribed cross-section sizes are used with specified features in prescribed specimen-fixture combinations.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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:*

E 4 Practices for Force Verification of Testing Machines[2]

C 1239 Practice for Reporting Uniaxial Strength Data and Estimating Weibull Distribution Parameters for Advanced Ceramics[3]

C 1322 Practice for Fractography and Characterization of Fracture Origins in Advanced Ceramics[3]

C 1368 Test Method for Determination of Slow Crack Growth Parameters of Advanced Ceramics by Constant Stress-Rate Flexural Testing at Ambient Temperature[3]

E 337 Test Method for Measured Humidity with a Psychrometer (The Measurement of Wet- and Dry-Bulb Temperatures)[4]

2.2 *Military Standard:*

MIL-STD-1942 (MR) Flexural Strength of High Performance Ceramics at Ambient Temperature[5]

3. Terminology

3.1 *Definitions:*

3.1.1 *complete gage section, n*—the portion of the specimen between the two outer bearings in four-point flexure and three-point flexure fixtures.

NOTE 1—In this standard, the complete four-point flexure gage section is twice the size of the inner gage section. Weibull statistical analysis only includes portions of the specimen volume or surface which experience tensile stresses.

3.1.2 *flexural strength*—a measure of the ultimate strength of a specified beam in bending.

3.1.3 *four-point–¼* point flexure—configuration of flexural strength testing where a specimen is symmetrically loaded at two locations that are situated one quarter of the overall span, away from the outer two support bearings (see Fig. 1).

3.1.4 *Fully-articulating fixture, n*—a flexure fixture designed to be used either with flat and parallel specimens or with uneven or nonparallel specimens. The fixture allows full independent articulation, or pivoting, of all rollers about the specimen long axis to match the specimen surface. In addition, the upper or lower pairs are free to pivot to distribute force evenly to the bearing cylinders on either side.

NOTE 2—See Annex A1 for schematic illustrations of the required pivoting movements.

NOTE 3—A three-point fixture has the inner pair of bearing cylinders replaced by a single bearing cylinder.

3.1.5 *inert flexural strength, n*—a measure of the strength of specified beam in bending as determined in an appropriate inert condition whereby no slow crack growth occurs.

NOTE 4—An inert condition may be obtained by using vacuum, low temperatures, very fast test rates, or any inert media.

3.1.6 *inherent flexural strength, n*—the flexural strength of a material in the absence of any effect of surface grinding or other surface finishing process, or of extraneous damage that may be present. The measured inherent strength is in general a function of the flexure test method, test conditions, and specimen size.

3.1.7 *inner gage section, n*—the portion of the specimen between the inner two bearings in a four-point flexure fixture.

[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] *Annual Book of ASTM Standards*, Vol 03.01.

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

[4] *Annual Book of ASTM Standards*, Vol 11.03.

[5] Available from Standardization Documents, Order Desk, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094.

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