



Standard Test Method for Flexural Strength of Advanced Ceramics at Elevated Temperatures¹

This standard is issued under the fixed designation C 1211; 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 flexural strength of advanced ceramics at elevated temperatures.² Four-point- $\frac{1}{4}$ point and three-point loadings with prescribed spans are the standard. Rectangular specimens of prescribed cross-section 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:

- 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
- C 1322 Practice for Fractography and Characterization of Fracture Origins in Advanced Ceramics³
- C 1341 Test Method for Flexural Properties of Continuous Fiber Reinforced Advanced Ceramic Composites³
- C 1368 Test Method for Determination of Slow Crack Growth Parameters of Advanced Ceramics by Constant Stress-Rate Flexural Testing at Ambient Temperature³
- C 1465 Test Method for Determination of Slow Crack Growth Parameters of Advanced Ceramics by Constant Stress-Rate Flexural Testing at Elevated Temperatures³
- E 4 Practices for Force Verification of Testing Machines⁴
- E 220 Test Method for Calibration of Thermocouples by

Comparison Techniques⁵

E 230 Temperature Electromotive Force (EMF) Tables for Standardized Thermocouples⁵

2.2 Military Standard:

MIL-STD 1942(A) Flexural Strength of High Performance Ceramics at Ambient Temperature⁶

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 analyses, in this instance, only include 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- $\frac{1}{4}$ point flexure*—a configuration of flexural strength testing in which a specimen is symmetrically loaded at two locations that are situated at 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 A2 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 a specified beam specimen in bending as determined in an appropriate inert condition whereby no slow crack growth occurs.

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 Elevated temperatures typically denote, but are not restricted to 200 to 1600°C.

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

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

⁵ *Annual Book of ASTM Standards*, Vol 14.03.

⁶ Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094. This document is a 1990 update of the original MIL-STD 1942(MR), dated November 1983.

*A Summary of Changes section appears at the end of this standard.

