



Standard Test Method for Monotonic Tensile Behavior of Continuous Fiber-Reinforced Advanced Ceramics with Solid Rectangular Cross-Section Test Specimens at Ambient Temperature¹

This standard is issued under the fixed designation C 1275; 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 tensile behavior including tensile strength and stress-strain response under monotonic uniaxial loading of continuous fiber-reinforced advanced ceramics at ambient temperature. This test method addresses, but is not restricted to, various suggested test specimen geometries as listed in the appendix. In addition, specimen fabrication methods, testing modes (force, displacement, or strain control), testing rates (force rate, stress rate, displacement rate, or strain rate), allowable bending, and data collection and reporting procedures are addressed. Note that tensile strength as used in this test method refers to the tensile strength obtained under monotonic uniaxial loading where monotonic refers to a continuous nonstop test rate with no reversals from test initiation to final fracture.

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

1.3 Values expressed in this test method are in accordance with the International System of Units (SI) and 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.* Specific hazard statements are given in Section 7 and Note 1.

2. Referenced Documents

2.1 ASTM Standards:

C 1145 Terminology of Advanced Ceramics²

C 1239 Practice for Reporting Uniaxial Strength Data and Estimating Weibull Distribution Parameters for Advanced Ceramics²

D 3039/D3039M Test Method for Tensile Properties of Polymer Matrix Composite Materials³

D 3379 Test Method for Tensile Strength and Young's Modulus for High-Modulus Single-Filament Materials³

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 177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods⁵

E 337 Test Method for Measuring Humidity with Psychrometer (the Measurement of Wet- and Dry-Bulb Temperatures)⁶

E 380 Practice for Use of International System of Units (SI) (the Modernized Metric System)⁷

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method⁵

E 1012 Practice for Verification of Specimen Alignment Under Tensile Loading⁴

3. Terminology

3.1 *Definitions*—The definitions of terms relating to tensile testing appearing in Terminology E 6 apply to the terms used in this test method. The definitions of terms relating to advanced ceramics appearing in Terminology C 1145 apply to the terms used in this test method. The definitions of terms relating to fiber reinforced composites appearing in Terminology D 3878 apply to the terms used in this test method. Pertinent definitions as listed in Practice E 1012, Terminology C 1145, Terminology D 3878, and Terminology E 6 are shown in the following with

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 14.02.

⁶ *Annual Book of ASTM Standards*, Vol 11.03.

⁷ Discontinued 1997—Replaced by IEEE/ASTM SI-10.

