



Standard Test Method for Tensile Properties of Fiber Reinforced Metal Matrix Composites¹

This standard is issued under the fixed designation D 3552; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This test method covers the determination of the tensile properties of metal matrix composites reinforced by continuous and discontinuous high-modulus fibers. Nontraditional metal matrix composites as stated in 1.1.6 also are covered in this test method. This test method applies to specimens loaded in a uniaxial manner tested in laboratory air at either room temperature or elevated temperatures. The types of metal matrix composites covered are:

1.1.1 *Unidirectional*—Any fiber-reinforced composite with all fibers aligned in a single direction. Continuous or discontinuous reinforcing fibers, longitudinal and transverse properties.

1.1.2 *0°/90° Balanced Crossply*—A laminate composed of only 0 and 90° plies. This is not necessarily symmetric, continuous, or discontinuous reinforcing fibers.

1.1.3 *Angleply Laminate*—Any balanced laminate consisting of $\pm$ theta plies where theta is an acute angle with respect to a reference direction. Continuous reinforcing fibers without 0° reinforcing fibers (that is, (± 45)ns, (± 30)ns, and so forth).

1.1.4 *Quasi-Isotropic Laminate*—A balanced and symmetric laminate for which a constitutive property of interest, at a given point, displays isotropic behavior in the plane of the laminate. Continuous reinforcing fibers with 0° reinforcing fibers (that is, (0/ ± 45 /90)s, (0/ ± 30)s, and so forth).

1.1.5 *Unoriented and Random Discontinuous Fibers*.

1.1.6 *Directionally Solidified Eutectic Composites*.

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

D 3039/D 3039M Test Method for Tensile Properties of Polymer Matrix Composite Materials²

D 3878 Terminology for Composite Materials²

E 4 Practices for Force Verification of Testing Machines³

E 8 Test Methods for Tension Testing of Metallic Materials³

E 83 Practice for Verification and Classification of Extensometers³

E 177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods⁴

E 220 Test Method for Calibration of Thermocouples by Comparison Techniques⁵

E 251 Test Methods for Performance Characteristics of Metallic Bonded Resistance Strain Gages³

E 456 Terminology Relating to Quality and Statistics⁴

E 1012 Practice for Verification of Specimen Alignment Under Tensile Loading³

3. Terminology

3.1 *Definitions*—Terminology D 3878 defines terms relating to high-modulus fibers and their composites. Terminology E 6 defines terms relating to mechanical testing. Terminology E 456 and Practice E 177 define terms relating to statistics. In the event of a conflict between terms, Terminology D 3878 shall have precedence over the other standards.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *continuous fiber, n*—a polycrystalline or amorphous fiber that is continuous within the sample or component or that has ends outside of the stress fields under consideration.

3.2.2 *discontinuous fiber, n*—a polycrystalline or amorphous fiber that is discontinuous within the sample or component or that has its ends inside the stress fields under consideration.

4. Summary of Test Method

4.1 A tension specimen is mounted in the grips of a

¹ This test method is under the jurisdiction of ASTM Committee D30 on Composite Materials and is the direct responsibility of Subcommittee D30.04 on Lamina and Laminate Test Methods.

Current edition approved Oct. 10, 1996. Published December 1996. Originally published as D 3552 – 77. Previous edition D 3552 – 77 (1989) ^{ϵ 1}.

² *Annual Book of ASTM Standards*, Vol 15.03.

³ *Annual Book of ASTM Standards*, Vol 03.01.

⁴ *Annual Book of ASTM Standards*, Vol 14.02.

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