



Standard Test Method for In-Plane Shear Response of Polymer Matrix Composite Materials by Tensile Test of a $\pm 45^\circ$ Laminate¹

This standard is issued under the fixed designation D 3518/D 3518M; 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 determines the in-plane shear response of polymer matrix composite materials reinforced by high-modulus fibers. The composite material form is limited to a continuous-fiber-reinforced composite $\pm 45^\circ$ laminate capable of being tension tested in the laminate χ direction.

1.2 *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.*

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. Within the text the inch-pound units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

2. Referenced Documents

2.1 ASTM Standards:

- D 883 Terminology Relating to Plastics²
- D 3039/D 3039M Test Method for Tensile Properties of Polymer Matrix Composite Materials³
- D 3878 Terminology for High-Modulus Reinforcing Fibers and Their Composites³
- D 5229/D 5229M Test Method for Moisture Absorption Properties and Equilibrium Conditioning of Polymer Matrix Composite Materials³
- E 6 Terminology Relating to Methods of Mechanical Testing⁴
- E 111 Test Method for Young's Modulus, Tangent Modulus, and Chord Modulus⁴
- E 177 Practice for Use of the Terms Precision and Bias in

ASTM Test Methods⁵

- E 456 Terminology Relating to Quality and Statistics⁵
- E 1309 Guide for Identification of Composite Materials in Computerized Material Property Databases³
- E 1313 Guide for Recommended Formats for Data Records Used In Computerization of Mechanical Test Data for Metals⁶
- E 1434 Guide for Development of Standard Data Records for Computerization of Mechanical Test Data for High-Modulus Fiber-Reinforced Composite Materials³
- E 1471 Guide for Identification of Fibers, Fillers, and Core Materials in Computerized Material Property Databases³

3. Terminology

3.1 **Definitions**—Terminology D 3878 defines terms relating to high-modulus fibers and their composites. Terminology D 883 defines terms relating to plastics. 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:

NOTE 1—If the term represents a physical quantity, its analytical dimensions are stated immediately following the term (or letter symbol) in fundamental dimension form, using the following ASTM standard symbolism for fundamental dimensions, shown within square brackets: [M] for mass, [L] for length, [T] for time, [Θ] for thermodynamic temperature, and [nd] for nondimensional quantities. Use of these symbols is restricted to analytical dimensions when used with square brackets, as the symbols may have other definitions when used without the brackets.

3.2.1 **$\pm 45^\circ$ laminate**—*in laminated composites*, a balanced, symmetric lay-up composed only of $+45^\circ$ plies and -45° plies. (See also *ply orientation*.)

3.2.2 **balanced, adj**—*in laminated composites*, having, for every off-axis ply oriented at $+\theta$, another ply oriented at $-\theta$ that is of the same material system and form.

3.2.3 **lamina, n—pl. laminae**, *in laminated composites*, a single, thin, uniform layer that is the basic building block of a laminate. (Syn. *ply*).

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 Nov. 15, 1994. Published January 1995. Originally published as D 3518 – 76. Last previous edition D 3518 – 91.

² Annual Book of ASTM Standards, Vol 08.01.

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 14.01.