



Standard Test Method for Translaminar Fracture Toughness of Laminated and Pultruded Polymer Matrix Composite Materials¹

This standard is issued under the fixed designation E1922; 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 translaminar fracture toughness, K_{TL} , for laminated and pultruded polymer matrix composite materials of various ply orientations using test results from monotonically loaded notched specimens.

1.2 This test method is applicable to room temperature laboratory air environments.

1.3 Composite materials that can be tested by this test method are not limited by thickness or by type of polymer matrix or fiber, provided that the specimen sizes and the test results meet the requirements of this test method. This test method was developed primarily from test results of various carbon fiber – epoxy matrix laminates and from additional results of glass fiber – epoxy matrix, glass fiber-polyester matrix pultrusions and carbon fiber – bismaleimide matrix laminates (1-4, 5, 6).²

1.4 A range of eccentrically loaded, single-edge-notch tension, ESE(T), specimen sizes with proportional planar dimensions is provided, but planar size may be variable and adjusted, with associated changes in the applied test load. Specimen thickness is a variable, independent of planar size.

1.5 Specimen configurations other than those contained in this test method may be used, provided that stress intensity calibrations are available and that the test results meet the requirements of this test method. It is particularly important that the requirements discussed in 5.1 and 5.4 regarding contained notch-tip damage be met when using alternative specimen configurations.

1.6 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

¹ This test method is under the jurisdiction of ASTM Committee E08 on Fatigue and Fracture and is the direct responsibility of Subcommittee E08.05 on Cyclic Deformation and Fatigue Crack Formation.

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² The boldface numbers in parentheses refer to the list of references at the end of this standard.

1.7 *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 to determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*³

D883 Terminology Relating to Plastics

D3039/D3039M Test Method for Tensile Properties of Polymer Matrix Composite Materials

D3878 Terminology for Composite Materials

D5229/D5229M Test Method for Moisture Absorption Properties and Equilibrium Conditioning of Polymer Matrix Composite Materials

D5528 Test Method for Mode I Interlaminar Fracture Toughness of Unidirectional Fiber-Reinforced Polymer Matrix Composites

E4 Practices for Force Verification of Testing Machines

E6 Terminology Relating to Methods of Mechanical Testing

E83 Practice for Verification and Classification of Extensometer Systems

E399 Test Method for Linear-Elastic Plane-Strain Fracture Toughness K_{Ic} of Metallic Materials

E1823 Terminology Relating to Fatigue and Fracture Testing

3. Terminology

3.1 *Definitions:*

3.1.1 Terminology E6, E1823, and D3878 are applicable to this test method.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *notch-mouth displacement*, V_n [L]*—*the Mode I (also called opening mode) component of crack or notch displacement due to elastic and permanent deformation. The displacement is measured across the mouth of the notch on the specimen edge (see Fig. 1).

3.2.2 *notch length*, a_n [L]*—*the distance from a reference plane to the front of the machined notch. The reference plane

³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.