



Designation: D6115 – 97 (Reapproved 2019)

Standard Test Method for Mode I Fatigue Delamination Growth Onset of Unidirectional Fiber-Reinforced Polymer Matrix Composites¹

This standard is issued under the fixed designation D6115; 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 determines the number of cycles (N) for the onset of delamination growth based on the opening mode I cyclic strain energy release rate (G), using the Double Cantilever Beam (DCB) specimen shown in Fig. 1. This test method applies to constant amplitude, tension-tension fatigue loading of continuous fiber-reinforced composite materials. When this test method is applied to multiple specimens at various G -levels, the results may be shown as a G - N curve, as illustrated in Fig. 2.

1.2 This test method is limited to use with composites consisting of unidirectional carbon fiber tape laminates with single-phase polymer matrices. This limited scope reflects the experience gained in round robin testing. This test method may prove useful for other types and classes of composite materials, however, certain interferences have been noted (see Section 6.5 of Test Method D5528).

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

1.3.1 *Exception*—The values provided in parentheses are for information only.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards*:²

- D883 Terminology Relating to Plastics
- D2584 Test Method for Ignition Loss of Cured Reinforced Resins
- D2651 Guide for Preparation of Metal Surfaces for Adhesive Bonding
- D2734 Test Methods for Void Content of Reinforced Plastics
- D3171 Test Methods for Constituent Content of 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
- E122 Practice for Calculating Sample Size to Estimate, With Specified Precision, the Average for a Characteristic of a Lot or Process
- E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods
- E456 Terminology Relating to Quality and Statistics
- E467 Practice for Verification of Constant Amplitude Dynamic Forces in an Axial Fatigue Testing System
- E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method
- E739 Practice for Statistical Analysis of Linear or Linearized Stress-Life (S - N) and Strain-Life (ϵ - N) Fatigue Data
- E1049 Practices for Cycle Counting in Fatigue Analysis
- E1150 Definitions of Terms Relating to Fatigue (Withdrawn 1996)³

¹ This test method is under the jurisdiction of ASTM Committee D30 on Composite Materials and is the direct responsibility of Subcommittee D30.06 on Interlaminar Properties.

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² 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.

³ The last approved version of this historical standard is referenced on www.astm.org.