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Standard Guide for Work of Fracture Measurements on Small Nuclear Graphite Specimens¹

This standard is issued under the fixed designation D8255; 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 guide provides general tutorial information and best practice for measuring the work of fracture on manufactured graphite and carbon specimens. Although applicable to all carbon and graphite materials, this guide is aimed specifically at measurements required on nuclear graphites, where there may be constraints on the geometry and/or volume of the test specimen.

1.2 The values stated in SI units are to be regarded as standard. The values given in parentheses after SI units are provided for information only and are not considered standard.

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

1.4 *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

C559 Test Method for Bulk Density by Physical Measurements of Manufactured Carbon and Graphite Articles

C651 Test Method for Flexural Strength of Manufactured Carbon and Graphite Articles Using Four-Point Loading at Room Temperature

C695 Test Method for Compressive Strength of Carbon and Graphite

C747 Test Method for Moduli of Elasticity and Fundamental Frequencies of Carbon and Graphite Materials by Sonic Resonance

C749 Test Method for Tensile Stress-Strain of Carbon and Graphite

C769 Test Method for Sonic Velocity in Manufactured Carbon and Graphite Materials for Use in Obtaining an Approximate Value of Young's Modulus

D4175 Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants

D7775 Guide for Measurements on Small Graphite Specimens

D7779 Test Method for Determination of Fracture Toughness of Graphite at Ambient Temperature

D7972 Test Method for Flexural Strength of Manufactured Carbon and Graphite Articles Using Three-Point Loading at Room Temperature

E4 Practices for Force Calibration and Verification of Testing Machines

E399 Test Method for Linear-Elastic Plane-Strain Fracture Toughness of Metallic Materials

3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms used in this guide, refer to Terminology **D4175**.

3.1.2 *work of fracture*, γ_f (J/m²), n —the total energy required to produce a unit area of fracture surface.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *absorbed energy*, n —the plastic energy absorbed by the system.

3.2.1.1 *Discussion*—This is primarily the work done to extend the crack but can also include other plastic strains related to the specimen, such as microcracking, or the entire system, usually related to the stiffness of the loading frame. These cases are discussed in detail in Section 10.

3.2.2 *total (consumed) energy*, n —the total energy calculated by the load-displacement trace in this type of test.

3.2.2.1 *Discussion*—This is the sum of the elastic energy that leads to elastic deformation of the specimen and the plastic energy, which is primarily the work done to extend the crack.

¹ This guide is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.F0 on Manufactured Carbon and Graphite Products.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at www.astm.org/contact. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

*A Summary of Changes section appears at the end of this standard