



Standard Classification for Fiber Reinforced Carbon-Carbon Composite Structures¹

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1. Scope

1.1 This classification covers fiber reinforced carbon-carbon (C-C) composite structures (flat plates, rectangular bars, round rods, and tubes) manufactured specifically for structural components. The carbon-carbon composites consist of carbon/graphite fibers (from PAN, pitch, or rayon precursors) in a carbon/graphite matrix produced by liquid infiltration/pyrolysis or by chemical vapor infiltration, or both.

1.2 The classification system provides a means of identifying and organizing different C-C composites, based on the fiber type, architecture class, matrix densification, physical properties, and mechanical properties. The system provides a top-level identification system for grouping different types of C-C composites into different classes and provides a means of identifying the general structure and properties of a given C-C composite. It is meant to assist the ceramics community in developing, selecting, and using C-C composites with the appropriate composition, construction, and properties for a specific application.

1.3 The classification system produces a classification code for a given C-C composite, which shows the type of fiber, reinforcement architecture, matrix type, fiber volume fraction, density, porosity, and tensile strength and modulus (room temperature).

1.3.1 For example, Carbon-Carbon Composites Classification Code, C3-A2C-4C2*-32—classification of a carbon-carbon composite material/component (C3) with PAN based carbon fiber (A) in a 2D (2) fiber architecture with a CVI matrix (C), a fiber volume of 45 % (4), a bulk density of 1.5 g/cc (C), an open porosity less than 2 % (2*), an average ultimate tensile strength of 360 MPa (3), and an average tensile modulus of 35 GPa (2).

1.4 This classification system is a top level identification tool which uses a limited number of composite properties for high level classification. It is not meant to be a complete, detailed material specification, because it does not cover the full range of composition, architecture, physical, mechanical,

fabrication, and durability requirements commonly defined in a full design specification. Guide C1783 provides extensive and detailed direction and guidance in preparing a complete material specification for a given C-C composite component.

1.5 *Units*—The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.6 *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:²

- C242 Terminology of Ceramic Whitewares and Related Products
- C559 Test Method for Bulk Density by Physical Measurements of Manufactured Carbon and Graphite Articles
- C709 Terminology Relating to Manufactured Carbon and Graphite
- C838 Test Method for Bulk Density of As-Manufactured Carbon and Graphite Shapes
- C1039 Test Methods for Apparent Porosity, Apparent Specific Gravity, and Bulk Density of Graphite Electrodes
- C1198 Test Method for Dynamic Young's Modulus, Shear Modulus, and Poisson's Ratio for Advanced Ceramics by Sonic Resonance
- C1259 Test Method for Dynamic Young's Modulus, Shear Modulus, and Poisson's Ratio for Advanced Ceramics by Impulse Excitation of Vibration
- C1275 Test Method for Monotonic Tensile Behavior of Continuous Fiber-Reinforced Advanced Ceramics with Solid Rectangular Cross-Section Test Specimens at Ambient Temperature
- C1773 Test Method for Monotonic Axial Tensile Behavior of Continuous Fiber-Reinforced Advanced Ceramic Tubular Test Specimens at Ambient Temperature

¹ This classification is under the jurisdiction of ASTM Committee C28 on Advanced Ceramics and is the direct responsibility of Subcommittee C28.07 on Ceramic Matrix Composites.

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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.