



Standard Test Method for Determination of Thermal Shock Resistance for Advanced Ceramics by Water Quenching¹

This standard is issued under the fixed designation C 1525; 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 describes the determination of the resistance of advanced ceramics to thermal shock by water quenching. The method builds on the experimental principle of rapid quenching of a test specimen at an elevated temperature in a water bath at room temperature. The effect of the thermal shock is assessed by measuring the reduction in flexural strength produced by rapid quenching of test specimens heated across a range of temperatures. For a quantitative measurement of thermal shock resistance, a critical temperature interval is determined by a reduction in the mean flexural strength of at least 30 %. The test method does not determine thermal stresses developed as a result of a steady state temperature differences within a ceramic body or of thermal expansion mismatch between joined bodies. The test method is not intended to determine the resistance of a ceramic material to repeated shocks. Since the determination of the thermal shock resistance is performed by evaluating retained strength, the method is not suitable for ceramic components; however, test specimens cut from components may be used.

1.2 The test method is intended primarily for dense monolithic ceramics, but may also be applicable to certain composites such as whisker- or particulate-reinforced ceramic matrix composites that are macroscopically homogeneous.

1.3 Values expressed in this standard test method are in accordance with the International System of Units (SI) and Standard IEEE/ASTM SI 10.

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

2. Referenced Documents

2.1 ASTM Standards:

- C 1145 Terminology of Advanced Ceramics²
- C 1161 Test Method for Flexural Strength of Advanced Ceramics at Ambient Temperature²
- C 1239 Practice for Reporting Uniaxial Strength Data and Estimating Weibull Parameters for Advanced Ceramics²
- C 1322 Practice for Fractography and Characterization of Fracture Origins in Advanced Ceramics²
- E 4 Practice for Force Verification of Testing Machines³
- E 6 Terminology Relating to Methods of Mechanical Testing³
- E 616 Terminology Relating to Fracture Testing²
- IEEE/ASTM SI 10 Standard for Use of the International System of Units (SI): The Modern Metric System⁴

2.2 European Standard:

- EN 820-3 Advanced Technical Ceramics—Monolithic Ceramics—Thermomechanical Properties—Part 3: Determination of Resistance to Thermal Shock by Water Quenching⁵

3. Terminology

3.1 *Definitions*—The terms described in Terminologies C 1145, E 6, and E 616 are applicable to this standard test method. Specific terms relevant to this test method are as follows:

3.1.1 *advanced ceramic, n*—a highly engineered, high performance, predominately non-metallic, inorganic, ceramic material having specific functional attributes. **C 1145**

3.1.2 *critical temperature difference, ΔT_c , n*—temperature difference between the furnace and the ambient temperature water bath that will cause a 30 % drop in the average flexural strength.

¹ This test method is under the jurisdiction of ASTM Committee C28 on Advanced Ceramics and is the direct responsibility of Subcommittee C28.01 on Properties and Performance.

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² *Annual Book of ASTM Standards*, Vol 15.01.

³ *Annual Book of ASTM Standards*, Vol 03.01

⁴ *Annual Book of ASTM Standards*, Vol 14.02.

⁵ Available from CEN, 36, rue de Stassart, B-1050 Brussels, Belgium, www.cenorm.be.