



Standard Test Method for Measurement of Ultrasonic Attenuation Coefficients of Advanced Ceramics by Pulse-Echo Contact Technique¹

This standard is issued under the fixed designation C1332; 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 a procedure for measurement of ultrasonic attenuation coefficients for advanced structural ceramic materials. The procedure is based on a broadband buffered piezoelectric probe used in the pulse-echo contact mode and emitting either longitudinal or shear waves. The primary objective of this test method is materials characterization.

1.2 The procedure requires coupling an ultrasonic probe to the surface of a plate-like sample and the recovery of successive front surface and back surface echoes. Power spectra of the echoes are used to calculate the attenuation spectrum (attenuation coefficient as a function of ultrasonic frequency) for the sample material. The transducer bandwidth and spectral response are selected to cover a range of frequencies and corresponding wavelengths that interact with microstructural features of interest in solid test samples.

1.3 The purpose of this test method is to establish fundamental procedures for measurement of ultrasonic attenuation coefficients. These measurements should distinguish and quantify microstructural differences among solid samples and therefore help establish a reference database for comparing materials and calibrating ultrasonic attenuation measurement equipment.

1.4 This test method applies to monolithic ceramics and also polycrystalline metals. This test method may be applied to whisker reinforced ceramics, particulate toughened ceramics, and ceramic composites provided that similar constraints on sample size, shape, and finish are met as described herein for monolithic ceramics.

1.5 This test method sets forth the constraints on sample size, shape, and finish that will assure valid attenuation coefficient measurements. This test method also describes the

instrumentation, methods, and data processing procedures for accomplishing the measurements.

1.6 This test method is not recommended for highly attenuating materials such as very thick, very porous, rough-surfaced monolithics or composites. This test method is not recommended for highly nonuniform, heterogeneous, cracked, defective, or otherwise flaw-ridden samples that are unrepresentative of the nature or inherent characteristics of the material under examination.

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 determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

C1331 Test Method for Measuring Ultrasonic Velocity in Advanced Ceramics with Broadband Pulse-Echo Cross-Correlation Method

E664 Practice for the Measurement of the Apparent Attenuation of Longitudinal Ultrasonic Waves by Immersion Method

E1316 Terminology for Nondestructive Examinations

E1495 Guide for Acousto-Ultrasonic Assessment of Composites, Laminates, and Bonded Joints

2.2 ASNT Document:

Recommended Practice SNT-TC-1A for Nondestructive Testing Personnel Qualification and Certification³

2.3 Military Standard:

MIL-STD-410 Nondestructive Testing Personnel Qualification and Certification⁴

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 Available from American Society for Nondestructive Testing (ASNT), P.O. Box 28518, 1711 Arlingate Ln., Columbus, OH 43228-0518, <http://www.asnt.org>.

⁴ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, <http://www.dodssp.daps.mil>.

¹ This test method is under the jurisdiction of ASTM Committee C28 on Advanced Ceramics and is the direct responsibility of Subcommittee C28.03 on Physical Properties and Non-Destructive Evaluation.

Current edition approved Feb. 1, 2013. Published April 2013. Originally approved in 1996. Last previous edition approved in 2007 as C1332– 01 (2007). DOI: 10.1520/C1332-01R13.