



Standard Guide for Testing the Thermal Properties of Advanced Ceramics¹

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1. Scope

1.1 This guide covers the thermal property testing of advanced ceramics, to include monolithic ceramics, particulate/whisker-reinforced ceramics, and continuous fiber-reinforced ceramic composites. It is intended to provide guidance and information to users on the special considerations involved in determining the thermal properties of these ceramic materials.

1.2 Five thermal properties (specific heat capacity, thermal conductivity, thermal diffusivity, thermal expansion, and emittance/emissivity) are presented in terms of their definitions and general test methods. The relationship between thermal properties and the composition, microstructure, and processing of advanced ceramics (monolithic and composite) is briefly outlined, providing guidance on which material and specimen characteristics have to be considered in evaluating the thermal properties of advanced ceramics. Additional sections describe sampling considerations, test specimen preparation, and reporting requirements.

1.3 Current ASTM test methods for thermal properties are tabulated in terms of test method concept, testing range, specimen requirements, standards/reference materials, capabilities, limitations, precision, and special instructions for monolithic and composite ceramics.

1.4 This guide is based on the use of current ASTM standards for thermal properties where appropriate and on the development of new test standards where necessary. It is not the intent of this guide to rigidly specify particular thermal test methods for advanced ceramics. Guidance is provided on how to utilize the most commonly available ASTM thermal test methods, considering their capabilities and limitations.

1.5 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard. See [IEEE/ASTM SI 10](#).

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 appro-*

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

2. Referenced Documents

2.1 *ASTM Standards*:²

2.1.1 *Specific Heat*:

[C351 Test Method for Mean Specific Heat of Thermal Insulation](#) (Withdrawn 2008)³

[D2766 Test Method for Specific Heat of Liquids and Solids](#)

[E1269 Test Method for Determining Specific Heat Capacity by Differential Scanning Calorimetry](#)

2.1.2 *Thermal Conductivity*:

[C177 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus](#)

[C182 Test Method for Thermal Conductivity of Insulating Firebrick](#)

[C201 Test Method for Thermal Conductivity of Refractories](#)

[C202 Test Method for Thermal Conductivity of Refractory Brick](#)

[C408 Test Method for Thermal Conductivity of Whiteware Ceramics](#)

[C518 Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus](#)

[C767 Test Method for Thermal Conductivity of Carbon Refractories](#)

[C1044 Practice for Using a Guarded-Hot-Plate Apparatus or Thin-Heater Apparatus in the Single-Sided Mode](#)

[C1045 Practice for Calculating Thermal Transmission Properties Under Steady-State Conditions](#)

[C1113 Test Method for Thermal Conductivity of Refractories by Hot Wire \(Platinum Resistance Thermometer Technique\)](#)

[C1114 Test Method for Steady-State Thermal Transmission Properties by Means of the Thin-Heater Apparatus](#)

[C1130 Practice for Calibrating Thin Heat Flux Transducers](#)

[E1225 Test Method for Thermal Conductivity of Solids](#)

¹ This guide 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.

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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.