



Standard Test Method for Thermal Diffusivity by the Flash Method¹

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1. Scope

1.1 This test method covers the determination of the thermal diffusivity of primarily homogeneous isotropic solid materials. Thermal diffusivity values ranging from 0.1 to 1000 (mm)² s⁻¹ are measurable by this test method from about 75 to 2800 K.

1.2 Practice E2585 is adjunct to this test method and contains detailed information regarding the use of the flash method. The two documents are complementing each other.

1.3 This test method is a more detailed form of Test Method C714, having applicability to much wider ranges of materials, applications, and temperatures, with improved accuracy of measurements.

1.4 This test method is intended to allow a wide variety of apparatus designs. It is not practical in a test method of this type to establish details of construction and procedures to cover all contingencies that might offer difficulties to a person without pertinent technical knowledge, or to restrict research and development for improvements in the basic technique.

1.5 This test method is applicable to the measurements performed on essentially fully dense (preferably, but low porosity would be acceptable), homogeneous, and isotropic solid materials that are opaque to the applied energy pulse. Experience shows that some deviation from these strict guidelines can be accommodated with care and proper experimental design, substantially broadening the usefulness of the method.

1.6 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.7 For systems employing lasers as power sources, it is imperative that the safety requirement be fully met.

1.8 *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.*

¹ This test method is under the jurisdiction of ASTM Committee E37 on Thermal Measurements and is the direct responsibility of Subcommittee E37.05 on Thermophysical Properties.

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2. Referenced Documents

2.1 ASTM Standards:²

C714 Test Method for Thermal Diffusivity of Carbon and Graphite by Thermal Pulse Method

E228 Test Method for Linear Thermal Expansion of Solid Materials With a Push-Rod Dilatometer

E2585 Practice for Thermal Diffusivity by the Flash Method

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *thermal conductivity*, λ , of a solid material—the time rate of steady heat flow through unit thickness of an infinite slab of a homogeneous material in a direction perpendicular to the surface, induced by unit temperature difference. The property must be identified with a specific mean temperature, since it varies with temperature.

3.1.2 *thermal diffusivity*, α , of a solid material—the property given by the thermal conductivity divided by the product of the density and heat capacity per unit mass.

3.2 Description of Symbols and Units Specific to This Standard:

3.2.1 D —diameter, m.

3.2.2 C_p —specific heat capacity, J·g⁻¹·K⁻¹.

3.2.3 k —constant depending on percent rise.

3.2.4 K —correction factors.

3.2.5 K_1 , K_2 —constants depending on β .

3.2.6 L —specimen thickness, mm.

3.2.7 t —response time, s.

3.2.8 $t_{1/2}$ —half-rise time or time required for the rear face temperature rise to reach one half of its maximum value, s.

3.2.9 t^* —dimensionless time ($t^* = 4\alpha_s t/D_T^2$).

3.2.10 T —temperature, K.

3.2.11 α —thermal diffusivity, (mm)²/s.

3.2.12 β —fraction of pulse duration required to reach maximum intensity.

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.