



Designation: D6744 – 06 (Reapproved 2017)^{ε1}

Standard Test Method for Determination of the Thermal Conductivity of Anode Carbons by the Guarded Heat Flow Meter Technique¹

This standard is issued under the fixed designation D6744; 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.

^{ε1} NOTE—Units formatting was corrected editorially in February 2017.

1. Scope

1.1 This test method covers a steady-state technique for the determination of the thermal conductivity of carbon materials in thicknesses of less than 25 mm. The test method is useful for homogeneous materials having a thermal conductivity in the approximate range $1 < \lambda < 30 \text{ W/(m}\cdot\text{K)}$, (thermal resistance in the range from 10 to $400 \times 10^{-4} \text{ m}^2 \cdot \text{K/W}$) over the approximate temperature range from 150 K to 600 K. It can be used outside these ranges with reduced accuracy for thicker specimens and for thermal conductivity values up to $60 \text{ W/(m}\cdot\text{K)}$.

NOTE 1—It is not recommended to test graphite cathode materials using this test method. Graphites usually have a very low thermal resistance, and the interfaces between the specimen to be tested and the instrument become more significant than the specimen itself.

1.2 This test method is similar in concept to Test Methods E1530 and C518. Significant attention has been paid to ensure that the thermal resistance of contacting surfaces is minimized and reproducible.

1.3 The values stated in SI units are regarded as standard.

1.3.1 *Exception*—The values given in parentheses are for information only.

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*:²

C518 Test Method for Steady-State Thermal Transmission

¹ This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.05 on Properties of Fuels, Petroleum Coke and Carbon Material. Current edition approved Jan. 1, 2017. Published February 2017. Originally approved in 2001. Last previous edition in 2011 as D6744 – 06 (2011)^{ε1}. DOI: 10.1520/D6744-06R17E01.

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.

Properties by Means of the Heat Flow Meter Apparatus
E1530 Test Method for Evaluating the Resistance to Thermal Transmission of Materials by the Guarded Heat Flow Meter Technique

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *average temperature, n*—the average temperature of a surface is the area-weighted mean temperature of that surface.

3.1.2 *heat flux transducer, HFT, n*—a device that produces an electrical output that is a function of the heat flux, in a predefined and reproducible manner.

3.1.3 *thermal conductance, C, n*—the time rate of heat flux through a unit area of a body induced by unit temperature difference between the body surfaces.

3.1.4 *thermal conductivity, λ, of a solid material, n*—the time rate of heat flow, under steady conditions, through unit area, per unit temperature gradient in the direction perpendicular to the area.

3.1.5 *thermal resistance, R, n*—the reciprocal of thermal conductance.

3.2 *Symbols:*

λ = thermal conductivity, $\text{W/(m}\cdot\text{K)}$, $[\text{Btu}\cdot\text{in}/(\text{h}\cdot\text{ft}^2\cdot^\circ\text{F})]$
 C = thermal conductance, $\text{W/(m}^2\cdot\text{K)}$, $[\text{Btu}/(\text{h}\cdot\text{ft}^2\cdot^\circ\text{F})]$
 R = thermal resistance, $\text{m}^2\cdot\text{K/W}$, $(\text{h}\cdot\text{ft}^2\cdot^\circ\text{F/Btu})$
 Δx = specimen thickness, mm, (in.)
 A = specimen cross sectional area, m^2 , (ft^2)
 Q = heat flow, W, (Btu/h)
 ϕ = heat flux transducer output, mV
 N = heat flux transducer calibration constant, $\text{W/(m}^2\cdot\text{mV)}$, $[\text{Btu}/(\text{h}\cdot\text{ft}^2\cdot\text{mV})]$
 $N\phi$ = heat flux, W/m^2 , $[\text{Btu}/(\text{h}\cdot\text{ft}^2)]$
 ΔT = temperature difference, $^\circ\text{C}$, $(^\circ\text{F})$
 T_g = temperature of guard heater, $^\circ\text{C}$, $(^\circ\text{F})$
 T_u = temperature of upper heater, $^\circ\text{C}$, $(^\circ\text{F})$
 T_l = temperature of lower heater, $^\circ\text{C}$, $(^\circ\text{F})$
 T_1 = temperature of one surface of the specimen, $^\circ\text{C}$, $(^\circ\text{F})$
 T_2 = temperature of the other surface of the specimen, $^\circ\text{C}$, $(^\circ\text{F})$