



Designation: E 1461 – 9201

Standard Test Method for Thermal Diffusivity of Solids 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 0.1×10^{-7} to $1000 \times 10^{-3} \text{ m}^2/\text{s}$ are readily measurable by this test method ~~and measurements can be made from about 100 75 to 2500 K normally in a vacuum or inert gas environment. 2800 K.~~

1.2 This test method is a more detailed form of Test Method C 714, but has applicability to much wider ranges of materials, applications, and temperatures, with improved accuracy of measurements.

1.3 This test method is applicable to the ~~measurement of a wide variety of homogeneous opaque~~ measurements performed on materials opaque to the spectrum of the energy pulse, but with special precautions; can be used on fully or partially transparent and some porous and composite materials. (see Appendix X1).

1.4 This test method is intended to allow a wide variety of apparatus ~~design and design accuracies to satisfy the requirements of specific measurements problems; 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 stop or 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 materials; however, in some cases it has shown to produce acceptable results when used with porous samples. Since the magnitude of porosity, pore shapes, sizes and parameters of pore distribution influence the behavior of the thermal diffusivity, extreme caution must be exercised when analyzing data. Special caution is advised when other properties, such as thermal conductivity, are derived from thermal diffusivity obtained by this method.~~

1.6 This test method can be considered an absolute (or primary) method of measurement, since ~~no heat flux~~ reference standards are required. It is ~~advisable~~ to use reference materials to verify the performance of the instrument used.

1.7 This method is ~~applicable only for~~ homogeneous solid materials, in the strictest sense; however, in some cases it has shown to produce data which may be useful in certain applications.

1.7.1 *Testing of Composite Materials*—When substantial inhomogeneity and anisotropy is present in a material, the thermal diffusivity data obtained with this method may be substantially in error. Nevertheless, such data, while usually lacking absolute accuracy, may be useful in comparing materials of similar structure. Extreme caution must be exercised when related properties, such as thermal conductivity, are derived, as composites may have heat flow patterns substantially different than uniaxial.

1.7.2 *Testing Liquids*—This method has found an especially useful application in determining thermal diffusivity of molten materials. For this technique, specially constructed sample enclosures must be used.

1.7.3 *Testing Layered Materials*—This method has also been extended to test certain layered structures made of dissimilar materials, where one of the layers is considered unknown. In some cases, contact conductance of the interface may also be determined.

1.68 The values stated in SI units are to be regarded as the standard.

1.79 *This standard does not purport to address all of the safety ~~problems; 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 714 Test Method for Thermal Diffusivity of Carbon and Graphite by a Thermal Pulse Method²

¹ This test method is under the jurisdiction of ASTM Committee E-37 on Thermal Measurements and is the direct responsibility of Subcommittee E37.05 on Thermophysical Properties.

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