ICS 81.040.01
CCS L 50

NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 7962.13-2025

Replacing GB/T 7962.13-1987

Test methods of colourless optical glass - Part 13: Thermal conductivity

无色光学玻璃测试方法 第13部分：导热系数

Issued on: June 30, 2025 **Implemented on: January 1, 2026**

**Issued by: State Administration for Market Regulation;
Standardization Administration of the PRC**

Table of Contents

1 Scope

This document describes a method for determining the thermal conductivity of colorless optical glass.

This document applies to the test of the thermal conductivity of colorless optical glass. The flash method applies to the dynamic test of thermal conductivity and thermal diffusivity at a given temperature point. The guarded hot plate method applies to the steady-state test of thermal conductivity at a stable temperature difference. The test of thermal conductivity for other types of glass may take this as a reference.

2 Normative References

GB/T 903-2019

3 Terms and Definitions

The following terms and definitions are applicable to this document.

3.1 Thermal diffusivity

A physical parameter characterizing the rate of temperature propagation during unsteady-state heat conduction.

3.2 Thermal conductivity

The amount of heat transferred per unit time through a unit area of material along the direction of heat flow under a unit temperature gradient.

3.3 Half-rise time

t1/2 The time required for the temperature on the back side of the sample to rise to half of its maximum value.

4.1 Principle

Under adiabatic conditions and at a certain temperature, a flash source instantaneously emits a pulse, uniformly illuminating the front side of the sample under test, causing its surface to absorb energy and instantly rise in temperature. This surface acts as the hot end, transferring energy to the cold end (i.e., the back side) via one-dimensional heat conduction. Use a temperature detector to continuously measure the corresponding temperature rise process at the center of the back side of the sample to obtain the relations between temperature T and the corresponding time t, thus obtaining the half-rise time t1/2.Based on t1/2 and the sample thickness, calculate the thermal diffusivity of the sample (see Figure 1).

Based on the thermal diffusivity, density and specific heat capacity of the sample, calculate the thermal conductivity of the sample.

Figure 1 -- Schematic Diagram of Test by Flash Method

4.2.1 Thermal conductivity meter for the flash method

The basic composition of the thermal conductivity meter for the flash method is shown in Figure 2 The instrument mainly consists of the following components.

a) Flash source. this can be a neodymium glass laser, a sapphire laser, or a precisely focused xenon lamp. The energy pulse period shall be less than 2% of the half-rise time t1/2, and the diameter of the light source pulse spot shall not be less than the outer diameter of the sample;

b) Heating furnace. this furnace brings the sample under test to the required temperature, with a temperature control accuracy of 0.1 ?C;

c) Temperature detector. an infrared detector is used, capable of providing a linear electrical signal output for minute temperature changes, and detecting changes in the initial sample temperature greater than 0.05 ?C.

Figure 2 -- Schematic Diagram of Basic Composition of Thermal Conductivity Meter for the Flash Method

4.2.2 Measuring instrument

With an accuracy not less than 0.01 mm.

4.3.1 Material requirements

The quality of the raw glass sample shall not be lower than the inclusion A0 and extent of striae C specified in GB/T 903-2019.The sample shall not soften, melt or undergo a chemical reaction within the test temperature range.

NOTE. inclusions are commonly referred to as the extent of bubble.

4.3.2 Processing requirements

The sample specifications are determined in accordance with the sample chamber of the thermal conductivity meter for the flash method. The sample thickness should preferably be 2 mm ? 0.1 mm. All surfaces shall be finely ground. The test surfaces of the sample (i.e., the front and back) shall be parallel planes with a thickness difference not exceeding 0.02 mm.

4.3.3 Pre-treatment of sample under test

Use ultrasonic equipment filled with ethanol to clean the sample, or directly use degreased cotton dipped with ethanol to wipe the sample clean.

4.4 Test Environment

Temperature. 20 ?C ? 5 ?C; relative humidity. ? 70%.

4.5 Test Procedures

4.5.1 Turn on the signal acquisition and processing system of the thermal conductivity meter for the flash method and ensure it reaches a stable operating state. Pour liquid nitrogen into the Dewar flask of the temperature detector.

4.5.2 Use a measuring instrument to measure the sample thickness. Select at least three different positions for measurement and take the arithmetic mean.

4.5.3 Deposit a very thin layer of opaque material (such as graphite, gold, silver, etc.) on both the front and back sides of the sample. The deposited layer shall uniformly and effectively cover the sample surface, with a thickness not exceeding 1% of the sample thickness. After the deposited layer on the sample surface has dried and stabilized, place the sample into the thermal conductivity meter for the flash method.

4.5.4 Evacuate the heating furnace, until the gas pressure does not exceed 1.5 ? 104 Pa. Then, use an inert gas (for example, Ar) to fill and replace the atmosphere in the furnace. Perform at least two cycles of evacuation and inert gas filling and replacement.

4.5.5 Set the test temperature and the flash source pulse energy (the pulse energy setting should ensure that the temperature rise on the back side of the sample does not exceed 5 ?C). Start the heating process and reach the measurement temperature.

4.5.6 Trigger the light source pulse, and collect and record the test temperature, the temperature rise curve of the sample's back side, etc. Repeat the test at each test temperature for each sample at least 3 times.

4.5.7 Change the test temperature and repeat test steps 4.5.5 ~ 4.5.6.

4.5.8 In accordance with the method specified in ASTM E1269-24, test the specific heat capacity of the glass. For the test of the specific heat capacity of glass by the flash method, refer to Appendix A.

4.6 Result Calculation

4.6.1 Based on the effective temperature rise curve of the sample obtained in 4.5.6 ~ 4.5.7, determine the baseline and the highest temperature rise, obtain the maximum temperature change, determine the half-rise time t1/2.In addition, in accordance with Formula (1), calculate the thermal diffusivity of the sample. Where, ?(T)---the thermal diffusivity at a specified temperature point T, expressed in (m2/s);

0.13879---the calculation coefficient;

d---the sample thickness, expressed in (m);

t1/2---the half-rise time, expressed in (s).

4.6.2 Based on the sample's thermal diffusivity, density and specific heat capacity, and in accordance with Formula (2), calculate the thermal conductivity of the sample. Where, ?(T)---the thermal conductivity at a specified temperature point T, expressed in [W/(m ? K)];

?(T)---the thermal diffusivity at a specified temperature point T, expressed in (m2/s);