

ICS 83.080.01



**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 19466.4-2025

**Plastics - Differential scanning calorimetry(DSC) method - Part
4: Determination of specific heat capacity
(English Translation)**

Issued on: December 2, 2025

Implemented on: July 1, 2026

Issued by: State Administration for Market Regulation

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1 Scope

This document describes a test method for determining the specific heat capacity of plastics using differential scanning calorimetry (DSC).

This document applies to the determination of the specific heat capacity of plastic materials.

2 Normative References

The contents of the following documents constitute indispensable clauses of this document through the normative references in the text. In terms of dated references, only the version with the specified date applies to this document. In terms of references without a specified date, the latest version (including all the modifications) is applicable to this document.

GB/T 2035 Plastics - Vocabulary (GB/T 2035-2024, ISO 472.2013, NEQ)

GB/T 6379.2 Accuracy (trueness and precision) of Measurement Methods and Results - Part 2.

Basic Method for the Determination of Repeatability and Reproducibility of a Standard Measurement Method

GB/T 8170 Rules of Rounding off for Numerical Values & Expression and Judgement of Limiting Values

GB/T 19466.1 Plastics - Differential Scanning Calorimetry (DSC) Method - Part 1.General Principles (GB/T 19466.1-2025, ISO 11357-1.2023, MOD)

3 Terms and Definitions

The terms and definitions defined in GB/T 2035 and GB/T 19466.1 and the following are applicable to this document.

3.1

calibration material

A substance with a known specific heat capacity.

NOTE: alpha-Al₂O₃ (e.g., synthetic sapphire) of 99.9% purity or higher is typically used as the calibration material.

3.2

specific heat capacity at constant pressure

C_p

At constant pressure, the amount of heat required to raise the temperature of a unit mass of a substance by 1 K.

NOTE 1: specific heat capacity is calculated using Formula (1).

Where, c_p ---the specific heat capacity, expressed in ($\text{kJ} \cdot \text{kg}^{-1} \cdot \text{K}^{-1}$) or ($\text{J} \cdot \text{g}^{-1} \cdot \text{K}^{-1}$); the subscript p indicates isobaric process;

m ---the mass of substance, expressed in (kg) or (g);

C_p ---the heat capacity, expressed in ($\text{kJ} \cdot \text{K}^{-1}$) or ($\text{J} \cdot \text{K}^{-1}$); the subscript p indicates isobaric process;

dQ ---at constant pressure, the amount of heat required to raise the temperature of a material of mass m by dT (K), expressed in (J).

In the temperature range where the material does not undergo a first-order phase transition,

Formula (2) is used for calculation. (dQ/dT) can be obtained by dividing the heat flow rate by the heating rate.

Where, (dQ/dt) ---the heat flow rate, expressed in ($\text{kJ} \cdot \text{s}^{-1}$), ($\text{J} \cdot \text{s}^{-1}$), or (W);

(dT/dt) ---the heating rate, expressed in ($\text{K} \cdot \text{s}^{-1}$).

NOTE 2: during a phase transition, heat capacity is discontinuous. Not all the heat consumed is used for heating, part of which is used to bring the material to a higher energy state.

Therefore, specific heat capacity can be measured outside the phase transition region.

4.1 Overview

Each measurement is performed at the same scan rate in three tests as follows (see Figure 1).

a) Blank test (both the specimen end and the reference end are empty crucibles);

Where,

ΔQ_{sp} ---the total heat consumed within the temperature interval ΔT of the specimen test, expressed in (kJ) or (J);

ΔQ_{cal} ---the total heat consumed within the temperature interval ΔT of the calibration test, expressed in (kJ) or (J);

ΔQ_{bl} ---the total heat consumed within the temperature interval ΔT of the blank test, expressed in (kJ) or (J);

ΔT ---the temperature interval, in seconds (s);

P ---the subscript that indicates isobaric process.

5.1 DSC Instrument

In accordance with the provisions of GB/T 19466.1.

5.2 Crucible

In accordance with the provisions of GB/T 19466.1.

The crucible for holding the specimen and the crucible for holding the reference material (calibration material) shall have the same shape and texture, and their masses shall be similar, with a difference not exceeding 0.1 mg.

NOTE: if the instrument is sufficiently stable, the mass difference between the crucible with calibration material and the blank crucible can be corrected, allowing the same blank test and calibration test results to be used for multiple measurements. Correction can be achieved by adding $c_{p,crucible}(T)\beta\Delta m$ to the heat flow rate of the calibration test, where $c_{p,crucible}(T)$ is the temperature-dependent specific heat capacity of the crucible with calibration material, β is the heating rate, and Δm is the mass difference between the crucible with calibration material and the blank crucible. The same method can be used to correct the mass difference between the specimen test crucible and the blank test crucible.

5.3 Analytical Balance

In accordance with the provisions of GB/T 19466.1.

6 Sample

In accordance with the provisions of GB/T 19466.1.

7 Test Conditions and Sample Conditioning

In accordance with the provisions of GB/T 19466.1.

8 Calibration

In accordance with the provisions of GB/T 19466.1.

9.1 Instrument Preparation

In accordance with the provisions of GB/T 19466.1.

9.2 Crucible Selection

Prepare three sets of crucibles and lids. Weigh each set of crucibles and lids together. The total mass difference between sets shall not exceed 0.1 mg (see 5.2). Furthermore, the texture, size, and type (open or sealed) of the crucibles shall be consistent.