

Methods of testing

Refractory materials —

Part 5: Refractory and thermal
properties —

Section 5.5 Determination of thermal
conductivity (panel/calorimeter
method) (method 1902-505)

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Committees responsible for this British Standard

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- British Ceramic Research Ltd.
- British Steel Industry
- Engineering Equipment and Materials Users' Association
- Refractories Association of Great Britain
- Refractory Contractors' Association
- Society of Glass Technology

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Contents

	Page
Committees responsible	Inside front cover
Foreword	ii
1 Scope	1
2 Designation	1
3 Definition	1
4 Principle	1
5 Apparatus	1
6 Test panel	6
7 Procedure	7
8 Calculation of thermal conductivity	9
9 Test report	10
Figure 1 — Vertical section through thermal conductivity apparatus	3
Figure 2 — Horizontal section, showing arrangement of heaters	3
Figure 3 — Basic circuit for heater control system	4
Figure 4 — Design of calorimeter and guard ring	5
Figure 5 — Arrangements for measurements in different dimensions	7
Figure 6 — Corresponding positions of thermocouples for arrangements in Figure 5	8
Table 1 — Resistance wire for heaters	4
Table 2 — Specific heat capacity of water	10
Publication(s) referred to	Inside back cover

Foreword

This Section of BS 1902-5 has been prepared under the direction of the Refractory Products Standards Policy Committee. The method described in this Section is one of three methods for the determination of thermal conductivity included in BS 1902-5, as follows.

- *Section 5.5: Determination of thermal conductivity (panel/calorimeter method) (method 1902-505);*
- *Section 5.6: Determination of thermal conductivity (hot wire method) (method 1902-506);*
- *Section 5.8: Determination of thermal conductivity (split column method) (method 1902-508)¹⁾.*

This Section of BS 1902 is a revision of the method previously included in BS 1902-1A:1966 (obsolescent), which is withdrawn.

NOTE This Section is to be read in conjunction with BS 1902-5.0 “*Introduction*” and BS 1902-3.1 “*Guidance on sampling*”. Section 5.0 sets out the general arrangement of BS 1902 and lists the Sections of Part 5.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 10, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

¹⁾ In preparation.

1 Scope

This Section of BS 1902-5 describes the panel method for determining the thermal conductivity of dense shaped and shaped insulating refractory products by a continuous flow calorimeter method. The panel/calorimeter method may be used for preformed unshaped products and for ceramic fibre products.

NOTE 1 For details of the adaptations needed for ceramic fibre products, see BS 1902-6.

The panel/calorimeter method is intended for materials having a thermal conductivity in the range 0.5 W/(m K) to 20 W/(m K) and hot face temperatures in the range 300 °C to 1 400 °C. For thermal conductivities below 0.5 W/(m K) see BS 1902-5.6.

NOTE 2 The titles of the publications referred to in this standard are listed on the inside back cover.

2 Designation

The method of determining thermal conductivity by the panel/calorimeter method described in this Section is referred to by the designation:

Method 1902-505

3 Definition

For the purposes of this Section of BS 1902, the following definition applies.

thermal conductivity (coefficient of thermal conductivity), λ , (in W/(m K))

the rate of linear heat flow, under steady state temperature conditions, through unit area of a test piece, per unit temperature gradient in a direction perpendicular to the area

4 Principle

The quantity of heat flow unidirectionally through a test panel, heated on one face under controlled temperature conditions, is measured using a continuous flow water calorimeter.

5 Apparatus

5.1 General

The apparatus consists of a furnace in which a system of heaters is used to induce a uniform, unidirectional heat flow through a test panel under stable temperature gradient conditions. A continuous flow water calorimeter with guard ring is used to measure the rate of flow of heat through the test panel.

5.2 Furnace, comprising a chamber, which accommodates a test

panel 230 mm × 230 mm × 76 (or 64) mm deep, and a heater well

nominally 214 mm × 214 mm × 58 mm deep formed from shaped insulating refractory (see Figure 1). The walls and floor of the heater well are formed of 25 mm thick insulating refractory, of class 150, complying with BS 7225-1.1. The walls of the heater well are lined with 8 mm thick, 50 mm deep alumino-silicate refractory plates (60 % to 65 % Al_2O_3) which stand on a 230 mm square, 8 mm thick base of the same material. The wall plates which act as a support for the test panel are pierced with 16 mm holes at 25 mm centres to accommodate the end of the main and side heater elements.

Behind the walls a narrow chamber, which accommodates the outer heater and lower peripheral heater, is formed on the inside from 8 mm thick alumino-silicate refractory (60 % to 65 % Al_2O_3) and on the outside from 25 mm thick insulating refractory of class 150, complying with BS 7225-1.1. The remainder of the brickwork surrounding the heater well and test panel chamber is made of insulating refractory of class 130, complying with BS 7225-1.1, with a final 76 mm thickness of lower temperature insulation, e.g. diatomite brick, to give overall furnace dimensions of 690 mm × 690 mm × 380 mm height. The furnace is encased in sheet metal, and supported in a steel frame, e.g. angle iron.

NOTE Alternate holes may be extended into vertical grooves to facilitate the removal of the heaters, as shown in Figure 2.

The upper and middle peripheral heaters and a supplementary heater, consisting of coiled electrical resistance wire (see 5.3), are laid in grooves cut in the insulating refractory. The upper and middle peripheral heaters are positioned 12 mm and 38 mm below the top level of brickwork and 33 mm behind the wall of the test panel chamber on all four sides. The supplementary heater is 50 mm below the base of the heater well and laid in a continuous groove having the form of a parallel-sided spiral covering an area of approximately 310 mm × 310 mm.