

Methods of testing

Refractory materials —

Part 5: Refractory and thermal
properties —

Section 5.8 Determination of thermal
conductivity (split column method)
(method 1902-508)

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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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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 (panell/method) 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).*

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 8, 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 Scope

This Section of BS 1902-5 describes the method for determining the thermal conductivity of shaped refractory products, having oxidizable constituents, by a split column method. The method may also be used for non-oxidizable products.

The method is principally intended for materials having a thermal conductivity in the range 3 W/(m K) to 80 W/(m K) and for mean temperatures (test piece) in the range 300 °C to 850 °C.

The method is not applicable to materials with constituents which are volatile at temperatures within the range of the test.

NOTE The best accuracy is attained when the thermal conductivity of the test piece is close to that of the alloy steel blocks (see 6.2).

2 References

2.1 Normative references

This Section of BS 1902 incorporates, by reference, provisions from specific editions of other publications. These normative references are cited at the appropriate points in the text and the publications are listed on the inside back cover. Subsequent amendments to, or revisions of, any of these publications apply to this Section of BS 1902 only when incorporated in it by updating or revision.

2.2 Informative references

This Section of BS 1902 refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on the inside back cover, but reference should be made to the latest editions.

3 Designation

The method of determining thermal conductivity by the split column method described in this Section is referred to by the designation:

Method 1902-508

4 Definition

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

thermal conductivity (coefficient of thermal conductivity) symbol λ , unit 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

5 Principle

The quantity of heat flowing through a test piece, immersed in a non-oxidizing atmosphere and located between two alloy steel blocks of known thermal conductivity, is determined by measurement of temperature gradients.

6 Apparatus

6.1 Thermal conductivity apparatus, with an arrangement for inducing heat flow through a test piece as shown in Figure 1. A mild steel cylindrical column 50^{+1}_0 mm in diameter and 200 mm $\pm$ 2 mm in length, with a ground flat smooth finish top surface perpendicular to the major axis, is supported vertically on a mild steel rigid base plate. The base of the column is recessed and fitted with inlet and outlet ports for continuous water flow. The column is enclosed by insulating firebrick in the form of a sectioned annular ring of at least 280 mm in height and 130 mm in thickness. The firebrick shall be of grade 125 in accordance with BS 7225-1.1:1989 and shall be held in close contact with the column by external strapping or equivalent means. The insulation shall extend for 76 mm above the column and shall be recessed for 25 mm over this height, as shown in Figure 1.

A portable radiant heater assembly, composed of four or five silicon carbide heaters (or equivalent elements), shown in Figure 2, is supported centrally on the insulating firebrick. The whole arrangement is enclosed by a removable airtight steel cover which can be bolted to the base plate using a vacuum proof seal, e.g. O-ring seal. The steel cover shall be made from a grade and gauge of steel sufficient to withstand a reduced interior pressure of less than 2 500 Pa.

Connections for the inlet/outlet ports for cooling water and gas, and entry for thermocouples and electric supply to the heater shall be built into the base plate with airtight seals. The evacuation port shall be either built into the base plate or be located in the steel cover.

A test piece, in the form of a cylinder, is located between two cylindrical alloy steel blocks of known thermal conductivity and the assembly is placed centrally on the mild steel column. The recess between the test piece and alloy steel blocks assembly and the insulating firebrick is packed with graded vermiculite.