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ISO 8841:1991
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Australian Standard®

Refractories and refractory materials—Physical test methods

Method 7: Permeability to gases

This Australian Standard® was prepared by Committee MN-007, Refractories and Refractory Materials. It was approved on behalf of the Council of Standards Australia on 7 October 2008.
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The following are represented on Committee MN-007:

- Australasian Institute of Mining and Metallurgy
- Australian Aluminium Council
- Australian Ceramic Society
- Bureau of Steel Manufacturers of Australia
- CSIRO Manufacturing & Materials Technology
- Cement Industry Federation
- Institute of Refractories Engineers
- Refractories Manufacturers Association of Australia
- The University of New South Wales

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Australian Standard®

Refractories and refractory materials—Physical test methods

Method 7: Permeability to gases

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PREFACE

This Standard was prepared by the Standards Australia Committee MN-007, Refractories and Refractory Materials, to supersede AS 1774.7—2001, *Refractories and refractory materials—Physical test methods*, Method 7: *Permeability to gases*.

The objective of this Standard is to provide the refractories industry with an internationally accepted method for the measurement of the permeability to gases of dense, shaped refractory products.

This Standard is identical with, and has been reproduced from ISO 8841:1991, *Dense, shaped refractory products—Determination of permeability to gases*.

As this Standard is reproduced from an international standard, the following applies:

(a) Its number appears on the cover and title page while the international standard number appears only on the cover.

(b) In the source text 'this International Standard' should read 'this Australian Standard'.

(c) Replace the text of Clause 9, Item c) with "a reference to this Australian Standard, i.e. 'Determined in accordance with AS 1774.7'".

(d) A full point substitutes for a comma when referring to a decimal marker.

References to International Standards should be replaced by references to Australian Standards, as follows:

Reference to International Standard		*Australian Standard*	
ISO		AS	
5022	Shaped refractory products—Sampling and acceptance testing	2497 2497.1	Procedures for acceptance testing of refractory products Part 1: Batch procedure
6906	Vernier callipers reading to 0,02 mm	1984	Vernier callipers (metric series)

INTRODUCTION

The permeability of a solid to gases is a property that is related to the distribution of the pores in the material and is therefore sensitive to variations in texture. It is not directly related to the apparent porosity and it shows a much greater variation than does porosity, both within a test piece and between several pieces.

It should also be noted that unlike density and porosity, permeability is a property that varies according to the direction in which the measurement is made and also, on occasion, according to the direction in which the gas is flowing.

The apparatus should not be influenced by air currents or by other localised changes in temperature.

AUSTRALIAN STANDARD

Refractories and refractory materials—Physical test methods

Method 7: Permeability to gases

1 Scope

This International Standard specifies a method for the measurement of the permeability to gases of dense, shaped refractory products.

NOTE 1 The method specified takes account of the dynamic viscosity of the gas, and therefore the results obtained may not be directly comparable with those obtained by earlier methods which took no account of viscosity. The determination is generally made by the passage of air. Other gases may be used when required, and the viscosities of air and nitrogen are given.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 6906:1984, *Vernier callipers reading to 0,02 mm.*

3 Definition

For the purposes of this International Standard, the following definition applies.

3.1 permeability of a material: The property by which the material allows a gas to pass through it when under a difference of pressure.

The permeability (μ) is calculated using the following equation, given for the volume of gas passing through a test piece in a given time:

$$\frac{V}{t} = \mu \cdot \frac{1}{\eta} \cdot \frac{A}{\delta} \cdot (p_1 - p_2) \cdot \frac{(p_1 + p_2)}{2p} \qquad \ldots (1)$$

where

V is the volume of gas passing through the material, in cubic metres;

t is the time, in seconds, in which that volume of gas passes through the material;

μ is the permeability of the material, in square metres;

η is the dynamic viscosity, in pascal seconds, of the gas at the temperature of the test;

A is the cross-sectional area, in square metres, of the material traversed;

δ is the thickness, in metres, of the material traversed;

p is the absolute pressure, in pascals, of the gas;

p_1 is the absolute pressure, in pascals, where the gas enters the material;

p_2 is the absolute pressure, in pascals, where the gas leaves the material.

NOTES

2 Equation (1) corresponds to Darcy's Law, and is deduced from the Hagen Poiseuille Law.

3 Since p is the pressure under which the volume of gas is measured, $p = p_1$ when operating under positive pressure, and $p = p_2$ when operating under negative pressure.

4 The factor $(p_1 + p_2)/2p$ is usually very close to unity and may be neglected when operating with small pressure differences, e.g. when $(p_1 - p_2)$ is less than 1 000 Pa.