AS 1038.12.2—1990

Australian Standard®

Methods for the analysis and testing of coal and coke

Part 12.2: Carbonization properties of higher rank coal—Determination of Gray–King coke type

STANDARDS AUSTRALIA

This Australian Standard was prepared by Committee MN/1, Coal and Coke. It was approved on behalf of the Council of Standards Australia on 16 September 1989 and published on 19 January 1990.

The following interests are represented on Committee MN/1:

Australasian Institute of Mining and Metallurgy
Australian Coal Association
Australian Coal Industry Research Laboratories
Australian Coal Preparation Society
Australian Institute of Energy
Bureau of Steel Manufacturers of Australia
Confederation of Australian Industry
CSIRO, Division of Coal Technology
Department of Minerals and Energy, N.S.W.
Department of Mines, Qld
Department of Primary Industries and Energy
Electricity Supply Association of Australia
Institution of Engineers, Australia
Joint Coal Board
National Association of Testing Authorities, Australia
Queensland Coal Board
Royal Australian Chemical Institute
Standing Committee on Coalfield Geology of New South Wales
University of New South Wales

This Standard was issued in draft form for comment as DR 88197.

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AS 1038.12.2 first published as part of AS CK2.3—1949.
AS CK2.3—1949 revised and redesignated in part as AS K152.12—1965 (endorsement of BS 1016: Part 12:1959 with amendment).
AS K152.12—1965 revised and redesignated in part as AS 1038.12.2—1980.
~~Second edition 1990~~ 1980
AS 1038.12.2 revised in part as AS 1038.12.2 - 1990.

PUBLISHED BY STANDARDS AUSTRALIA
(STANDARDS ASSOCIATION OF AUSTRALIA)
STANDARDS HOUSE, 80 ARTHUR ST, NORTH SYDNEY NSW
ISBN 0 7262 5932 2

PREFACE

This Standard was prepared by the Standards Australia Subcommittee on Coal Evaluation under the supervision of the Committee on Coal and Coke and the direction of the Minerals Standards Board, as a revision of AS 1038.12.2—1980, *Methods for the analysis and testing of coal and coke,* Part 12.2: *Assessment of coking power of hard coal: Gray-King coke type test.* This Standard is technically equivalent to ISO 502, *Coal—Determination of caking power—Gray-King coke test,* and BS 1016.12, *Methods for the analysis and testing of coal and coke,* Part 12: *Caking and swelling properties of coal.*

AS 1038.12 will comprise the following parts:

(a) Carbonization properties of higher rank coal—Determination of the crucible swelling number.

(b) Carbonization properties of higher rank coal—Determination of Gray-King coke type.

(c) Carbonization properties of higher rank coal—Determination of dilatometer characteristics.

(d) Carbonization properties of higher rank coal—Determination of plastic properties by the Gieseler method—Manual method.

(e) Carbonization properties of higher rank coal—Determination of plastic properties by the Gieseler method—Automatic method.

This revision is predominantly editorial, the major difference from the previous edition being the deletion of the Appendix describing the determination of the bulk density of electrode carbon. The bulk density method will be included in a new Standard related to the bulk density of higher rank coal and coke. In the interim, reference may be made to ISO 502 for determination of the bulk density of the inert carbonaceous additive.

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Part 12.2: Carbonization properties of higher rank coal—Determination of Gray-King coke type

1 SCOPE. This Standard sets out a method for the determination of the Gray-King coke type of higher rank coal. The test is designed to assess the coking properties of a coal or a blend of coals by carbonizing under standardized conditions.

NOTE: Interpretation of the results of the tests in terms of the coking properties may differ between coals.

2 REFERENCED DOCUMENTS. The following documents are referred to in this Standard:

AS
1038 Methods for the analysis and testing of coal and coke
1038.4 Part 4: Proximate analysis of coke
1038.16 Part 16: Acceptance and reporting of results
1038.21 Part 21: Determination of the relative density and apparent relative density of hard coal
2646 Sampling of solid mineral fuels
2646.6 Part 6: Hard coal—Preparation of samples
TR2.3 Certified reference materials Electrode carbon—(For use in Gray-King coke type test (AS 1038.12.2))—Preparation and certification of ASCRM-003

ISO
502 Coal—Determination of caking power—Gray-King coke test

3 PRINCIPLE. The coal is heated under standardized conditions to a final temperature of 600 °C. The coke residue obtained is classified by strength and degree of swelling.

If the coke residue produced is so swollen that it fills the cross-section of the retort tube, the determination is repeated with a mixture of the coal and a suitable quantity of inert carbonaceous additive or equivalent material. For these highly swelling coals, the Gray-King coke type is defined by the minimum amount of inert carbonaceous additive required to produce a strong hard coke residue of the same volume as the original coal and inert carbonaceous additive mixture.

4 INERT CARBONACEOUS ADDITIVE. A suitable inert carbonaceous additive is ASCRM-003, which is available from Standards Australia. The preparation and certification of ASCRM-003 are described in TR2.3. Alternatively, an inert carbonaceous material meeting the following requirements may be used:

(a) Moisture ..... less than 1 percent (when determined in accordance with AS 1038.4).

(b) Volatile matter ..... less than 1.5 percent (when determined in accordance with AS 1038.4).

(c) Ash ..... less than 5 percent (when determined in accordance with AS 1038.4).

(d) Bulk density at 25 °C ..... 1000 g/L to 1050 g/L (when determined in accordance with ISO 502).

(e) Relative density at 25 °C ..... 2.05 to 2.09 (when determined in accordance with AS 1038.21).

(f) Size distribution by mass—

Size fraction, μm (square mesh)	*Mass,* percent
+212	< 1
−212 +125	< 26
−125 +63	⩾10 ⩽ 40
−63	⩾50 ⩽ 85

5 APPARATUS.

5.1 Furnace—electric furnace, incorporating a horizontal refractory tube, 50 mm internal diameter and 300 mm long, with one end closed and the other carrying a plug of insulating material which is bored centrally with a hole 25 mm in diameter. Alternatively, the furnace may be constructed from an electrically-heated non-oxidizable metal block, with one or several holes of 25 mm diameter bored into it. (The multiple-tube furnace permits simultaneous determinations to be performed.) The design of the furnace shall be such that the middle 200 mm is at a uniform temperature, within ±5 °C, at both 300 °C and 600 °C. The furnace shall be insulated, and shall be equipped with a thermocouple, lying above the retort tube when the latter is in position and with the junction at the centre of the furnace. An indicator shall be provided for showing the furnace temperature with an accuracy of ±5 °C. A means of controlling the energy input, preferably a programmed temperature controller, shall also be provided to permit an increase in temperature at the rate specified in Clause 7.2(e). The furnace may be of the fixed type or mounted on rails. A suitable furnace is shown in Figure 1.

5.2 Retort tube assembly—a heat-resistant glass or transparent silica tube, 20 ±1 mm internal diameter and 300 ±5 mm long, closed at one end, with a side-arm, 8 ±1 mm internal diameter and 50 ±5 mm long, located at a distance of 20 ±2 mm from the open end. The tube shall be smooth and either of uniform bore, as shown in Figure 2, or with a slight taper (19 mm to 21 mm) such that the open end is the larger. The retort is fitted with a heat-resistant stopper,