Australian Standard®

METHODS FOR THE ANALYSIS AND TESTING OF BROWN COAL AND BROWN COAL CHAR

Part 4—DETERMINATION OF THE APPARENT DENSITY OF DRIED LOWER RANK COAL AND ITS CHARS (MERCURY DISPLACEMENT METHOD)

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Australasian Institute of Mining and Metallurgy
Australian Coal Association
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Australian Institute of Energy
Bureau of Steel Manufacturers of Australia
Coal Preparation Societies of New South Wales and Queensland
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PREFACE

This standard was prepared by the Association's Committee on Coal and Coke under the direction of the Minerals Standards Board as a further part in the series of standards for the analysis and testing of brown coal and brown coal char.

The physical structure (porosity) of dried brown coal varies as a result of lithotype variation. This variation is readily observed by determining the apparent density of dried coal samples. The method described in this standard measures the apparent density by displacement of mercury at atmospheric pressure; at this pressure mercury will not penetrate pores smaller than 11.2 μm. Effectively, the apparent density obtained by this method is the particle density of the coal. The method is quick, accurate, and readily carried out.

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STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard

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PART 4—DETERMINATION OF THE APPARENT DENSITY OF DRIED LOWER RANK COAL AND ITS CHARS (MERCURY DISPLACEMENT METHOD)

1 SCOPE. This standard sets out a mercury displacement method for the determination of the apparent density of dried lower rank coal and its char.

2 REFERENCED DOCUMENTS. The following standard is referred to in this standard:

BS 5497 Precision of Test Methods
Part 1—Guide for the Determination of Repeatability and Reproducibility for a Standard Test Method.

3 APPARATUS.

3.1 Density measurement apparatus. The apparatus is illustrated in Fig. 1 and consists of—

(a) the pycnometer bulb (A) (minimum of 7 mL) and the stem (B);

(b) the mercury reservoir (C) and vacuum chamber (D) connected by a greaseless stopcock (E).

3.2 Analytical balance. Capable of weighing to an accuracy of 0.1 mg.

3.3 Mechanical vacuum pump. Capable of maintaining a pressure of 0.13 Pa.

NOTE: If required, four sets of apparatus can be evacuated simultaneously by one mechanical pump with a capacity of 60 L/min.

4 REAGENTS.

4.1 Distilled mercury. (commercially available)

NOTE: Mercury is a hazardous chemical and special care is needed to avoid spillages or storage in unsealed containers.

4.2 High vacuum stopcock grease. (not a silicone-base grease)

5 SAMPLES. The sample shall be air-dried and crushed to pass a 1.70 mm test sieve, with the minus 600 μm material being discarded.

6 PROCEDURE.

6.1 Calibration. The pycnometer bulb and stem shall be calibrated as follows:

(a) Grease the stem (B), insert into the pycnometer bulb (A) and then weigh to the nearest 0.1 mg.

(b) Place the assembled pycnometer bulb, stem and seat into the vacuum chamber (D).

(c) Evacuate the chamber through the vacuum stopcock (F) and fill with mercury by opening the stopcock (E) until the mercury is at least 10 mm above the top of the stem (B). Close (E).

(d) Carefully open the vacuum stopcock (F) to the atmosphere, thereby filling the bulb and stem with mercury. Run mercury from the chamber back into the reservoir by slowly opening the greaseless stopcock (E). Close (E) before the mercury level reaches it.

(e) Open the vacuum chamber at the ground joint (G) and carefully remove the seat with the mercury filled bulb.

(f) Remove the seat and weigh the bulb to the nearest 0.1 mg after brushing off any droplets from the outer surface; also remove excess mercury from the meniscus in stem (B).

(g) Calculate the volume of the bulb assembly from the increase in mass of the bulb and the density of mercury at the measured temperature.

6.2 Determination. Determine the apparent density of the sample as follows:

(a) Weigh the bulb and stem with the stem cone greased but not inserted in the bulb.

(b) Fill the bulb with ground sample freshly dried in an air oven at 105°C for 1 h for air-dried lower rank coal, or at 240°C for 1 h for its char. Reweigh the bulb plus stem.

(c) Place the stem in the bulb containing the test portion. Locate it in the seat and enclose the assembly in the vacuum chamber. Evacuate the chamber through the vacuum stopcock (F), with the mercury stopcock (E) closed, to a pressure of 0.13 Pa, and allow it to remain at this pressure for 30 min to remove the air.

(d) Raise the mercury level in the chamber by carefully opening the mercury stopcock (E) until the level is at least 10 mm above the top of the stem.

(e) Close the mercury stopcock (E) and open carefully the chamber to the atmosphere through the stopcock (F), thereby filling the bulb and stem completely with mercury.

(f) Run the mercury from the chamber back into the reservoir (C) by slowly opening greaseless stopcock (E). Close (E) before the mercury level reaches it.

(g) Open the vacuum chamber at the ground joint (G) and carefully remove the mercury filled bulb assembly. Weigh the assembly to the nearest 0.1 mg after brushing off any droplets of mercury on the outer surface.

6.3 Emptying the bulb. Empty the bulb as follows:

(a) Shake the mercury in the stem into a suitable container.

(b) Attach the stem to a rubber tube connected to the top of a vacuum filter flask, the side arm of which is connected to a vacuum line.