Australian Standard®

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

Part 3—DETERMINATION OF THE MOISTURE HOLDING CAPACITY OF LOWER RANK COALS

This Australian standard was prepared by Committee MN/1, Coal and Coke. It was approved on behalf of the Council of the Standards Association of Australia on 4 July 1984 and published on 5 October 1984.

The following interests are represented on Committee MN/1:

Australasian Institute of Mining and Metallurgy

Australian Coal Association

Australian Coal Industry Research Laboratories Ltd

Australian Institute of Energy

Bureau of Steel Manufacturers of Australia

Coal Preparation Societies of New South Wales and Queensland

Confederation of Australian Industry

CSIRO, Division of Fossil Fuels

Department of Mineral Resources, N.S.W.

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Joint Coal Board

Queensland Coal Board

Royal Australian Chemical Institute

Standing Committee on Coalfield Geology, N.S.W.

State Chemical Laboratory, Vic.

Universities

First published 1984

This Standard was issued in draft form for comment as DR 83066.

ISBN 0 7262 3500 8

PREFACE

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

The moisture holding capacity is an indicator of the rank of lower rank coals and is used in coal classification for correcting the specific energy of the sample to moist mineral-matter-free basis. The full moisture holding capacity is that of the coal in equilibrium with an atmosphere saturated with water vapour. The moisture content of the air-dried sample will change with atmospheric conditions (partial pressure of water vapour). These conditions will vary both between the coal sample preparation room and the analytical laboratory and on a daily basis in the laboratory. Therefore, moisture determinations should be carried out at the same time as determinations of other parameters. Since there are insuperable experimental difficulties in working with an atmosphere saturated with water vapour, the determination is carried out at 96 percent relative humidity.

The moisture holding capacity of higher rank coals closely represents their bed moisture content. However, for lower rank coals this may not be the case*.

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* International System for Classifying Brown Coals and Lignites and its Application to American Coal. W.H. ODE and F.H. GIBSON, Bureau of Mines RI 5695, 1960, p14.

CONTENTS

STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard

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

PART 3—DETERMINATION OF THE MOISTURE HOLDING CAPACITY OF LOWER RANK COALS

1 SCOPE. This standard sets out a method for determining the moisture holding capacity of lower rank coals (i.e. coals at the lower end of the coalification series, such as brown coal).

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

AS 1038 Methods for the Analysis and Testing of Coal and Coke
Part 1—Total Moisture in Hard Coal

AS 1152 Test Sieves

ISO 1018 Hard Coal—Determination of Moisture-holding Capacity.

3 PRINCIPLE. The coal is brought to equilibrium with an atmosphere of 96 percent relative humidity (attained by means of a saturated solution of potassium sulphate) at 30°C and then dried to constant mass at 105°C. The conditioning of the coal is carried out under reduced pressure. The moisture holding capacity is reported as a percentage, by mass, of the conditioned moist coal.

4 REAGENTS.

4.1 Potassium sulphate pulp. Add sufficient potassium sulphate to water to form a pulp so that solid potassium sulphate protrudes above the air/pulp interface.

4.2 Nitrogen. Dry and containing less than 10 μL of oxygen per litre (commercially available).

4.3 Desiccant. Anhydrous magnesium perchlorate desiccant for use in the desiccators.

5 APPARATUS.

5.1 Conditioning vessel. The conditioning vessel shall be a vacuum desiccator with a base diameter 120 mm to 150 mm and of sufficient depth to accommodate a bed of potassium sulphate pulp 30 mm to 40 mm thick. The desiccator is fitted with a glass or corrosion-resistant metal stand to carry dishes above the level of the pulp, so that the dishes are protected from spray due to frothing.

5.2 Constant temperature incubator. Anhydric or water-jacketed incubators have been found suitable. An example of an anhydric incubator is detailed in Appendix A. Commercially available water-jacketed incubators typically consist of an outer mild steel casing, with an inner casing of double wall copper sheet which form the water jacket. A glass door seals the inner casing.

It is recommended that the temperature be controlled using solid-state proportional controllers.

5.3 Dishes. Dishes shall be made of glass or silica approximately 50 mm diameter and 10 mm deep. The lids for these dishes should form a sliding fit.

5.4 Vacuum pump.

5.5 Drying oven. A minimum free space oven capable of being maintained at a temperature of 105 ± 2°C and with provision for passing a current of dry, oxygen-free nitrogen through it at a rate sufficient to change the atmosphere 30 times per hour. A description of such an oven can be found in AS 1038, Part 1.

6 SAMPLING AND SAMPLE PREPARATION.

Sampling shall be performed on bed-moist coal. Thus it is important that samples are taken as soon as coal is mined or cored and as close as possible to the extraction process.

Once the sample has been taken, it shall be stored immediately in moisture-tight containers.

The gross sample shall be crushed quickly to pass a sieve of 11.2 mm aperture.

A subsample with a mass of 500 g shall then be taken from the crushed gross sample and crushed quickly to pass a sieve of 4.00 mm aperture, complying with AS 1152.

The crushed subsample shall be stored in a moisture-tight container prior to analysis. Precautions should be taken to prevent loss of moisture during handling, crushing and subsampling operations.

7 PROCEDURE.

7.1 Number of determinations. Carry out the analysis in duplicate on each test sample.

7.2 Preparation of apparatus. Fill the conditioning vessel with the potassium sulphate pulp (4.1) to the required depth, ensuring that an excess of potassium sulphate is present.

Evacuate the desiccator several times until frothing ceases. To minimize subsequent frothing, the desiccator should be kept evacuated when not in use.

7.3 Conditioning the dish and coal. Weigh the empty dish and lid (m_1) and spread uniformly into it approximately 5 g of crushed coal. Cover the dish loosely with its lid and place in the conditioning vessel. Replace the lid of the conditioning vessel and reduce the pressure until the potassium sulphate pulp bubbles freely. Allow the bubbling to continue for 1 min to 2 min. Transfer the vessel to the incubator maintained at a temperature of 30.0 ± 0.1°C. Allow the samples seven days to reach moisture equilibrium.

At the end of seven days, return the conditioning vessel to atmospheric pressure by slowly allowing air to leak into it through a bubbler containing a saturated solution of potassium sulphate at 30°C. Air flow into the conditioning vessel should be adjusted so that it takes at least 15 min for the pressure in the conditioning vessel to reach atmospheric pressure.