Australian Standard®

METHODS FOR THE ANALYSIS AND TESTING OF LOWER RANK COAL AND ITS CHARS

Part 6.1—ULTIMATE ANALYSIS OF LOWER RANK COAL— CLASSICAL METHODS

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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
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Department of Mineral Resources, N.S.W.
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Institution of Engineers, Australia
Joint Coal Board
Queensland Coal Board
Royal Australian Chemical Institute
Standing Committee on Coalfield Geology, N.S.W.
State Chemical Laboratory, Vic.
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Representatives of the following interests also participated in the drafting of this Australian standard:

Australian Mineral Development Laboratories
Cement Manufacturing
Char Producers
Coal Corporation of Victoria
Electricity Trust of South Australia
State Electricity Commission of Victoria

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PREFACE

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

This standard is a companion document to AS 2434.6.2*, a rapid instrumental method using at least 100 mg coal samples.

The standard is based on AS 1038.6, Methods for the Analysis and Testing of Coal and Coke, Part 6—Ultimate Analysis of Higher Rank Coal, which has been specifically modified to meet the analytical requirements of lower rank Australian coals.

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* In course of preparation.

CONTENTS

FOREWORD

As a general rule, standards suitable for lower rank coals can also be applied to higher rank coals, but the reverse does not apply. Some features specific to lower rank coal methods are as follows:

(a) *Sample mass.* Because of the greater heterogeneity of lower rank coals, relatively large sample masses are essential for successful analyses, and semi-micro methods are not applicable.

(b) *Sample condition.* Many lower rank coals are powerful desiccants and adsorb water even in desiccators. Preparation of lower rank coal samples for analysis should involve either air equilibration followed by a moisture determination concurrent with the analysis, or complete drying and encapsulation of the sample.

(c) *Carbon and hydrogen.* The Liebig principle is preferred for the determination of carbon and hydrogen in lower rank coals, because some high volatile coals can explode under the heating conditions of the high temperature method.

STANDARDS ASSOCIATION OF AUSTRALIA

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METHODS FOR THE ANALYSIS AND TESTING OF LOWER RANK COAL AND ITS CHARS

PART 6.1—ULTIMATE ANALYSIS OF LOWER RANK COAL—CLASSICAL METHODS

1 SCOPE. This standard sets out the method of determining the ultimate analysis of lower rank coals and char in terms of their carbon, hydrogen, nitrogen and sulphur contents.

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 3 —Proximate Analysis of Hard Coal
- Part 8 —Chlorine in Coal and Coke
- Part 16—Acceptance and Reporting of Results
- Part 23—Determination of Carbonate Carbon in Higher Rank Coal

AS 1152 Test Sieves

AS 2165 Burettes and Bulb Burettes

AS 2167 Straight Pipettes

AS 2418 Glossary of Terms Relating to Solid Mineral Fuels
- Part 3 —Terms Relating to Brown Coal
- Part 4 —Terms Relating to Sampling, Sample Preparation, Analysis, Testing and Statistics

AS 2434 Methods for the Analysis and Testing of Lower Rank Coal and Its Chars
- Part 7 —Determination of Moisture in the Analysis Sample of Lower Rank Coal

AS XXXX Sampling of Lower Rank Coals*

ISO 1994 Hard Coal—Determination of Oxygen Content

BS 1041 Code for Temperature Measurement

BS 1752 Laboratory Sintered or Fritted Filters.

3 DEFINITIONS. For the purpose of this standard, the definitions in AS 2418.3 and AS 2418.4 apply.

4 INTRODUCTION. The ultimate analysis of coal comprises the determination of the elements carbon, hydrogen, nitrogen, sulphur and oxygen. This standard describes the determination of the total amounts of the first four elements, regardless of their mode of occurrence; oxygen is estimated by difference, because simple direct methods of sufficient accuracy are not available. Hydrogen includes that present both in the moisture and in the water of hydration of constituents of the mineral matter. All nitrogen is assumed to be present in the coal substance. Sulphur is normally present in three forms: as iron pyrites (FeS_2), as inorganic sulphates associated with the mineral matter, and as organic sulphur compounds in the coal substance.

The data obtained from use of this standard will not lead to a useful estimate of the percentage of oxygen in lower rank coal. An accurate estimate of the oxygen content can only be obtained by expressing the carbon, hydrogen, nitrogen and sulphur contents on a dry, mineral and inorganic free (dmif) basis. This in turn requires a separate determination of coal minerals and inorganic matter†. The dmif expression of results for lower rank coals is discussed in AS 1038.16.

Where the temperature for a particular operation is specified as a definite figure, it is to be understood that this figure should be attained as closely as possible and that it should be subject only to the errors inherent in accurate measurement, as defined in BS 1041.

Where a temperature range is given, the temperature may be anywhere in the range without detriment to the result. However, the mean of the range should be targeted so the inherent errors in measurement do not cause a temperature outside the specified range to be used inadvertently.

5 COAL SAMPLE.

5.1 General. The coal used for the ultimate analysis is the analysis sample ground to pass a 212 μm test sieve complying with AS 1152, taken and prepared in accordance with AS XXXX. The analysis sample may be prepared to either one of two states, air-dry or dry. If an air-dry sample is used, samples for moisture determination shall be taken and analysed concurrently with the ultimate analysis.

5.2 Preparation of air-dry coal. The sample received in the laboratory shall be brought into approximate equilibrium with the laboratory atmosphere by exposing it in a thin layer of not more than 15 mm on a tray. As many lower rank coals are prone to oxidation, the exposure time shall be kept to a minimum. The sample shall be thoroughly mixed, preferably by mechanical means, immediately before the determination.

5.3 Preparation of dry coal.

5.3.1 *Sample for carbon and hydrogen.* Air-dry coal shall be used to prepare the dry sample. A small platinum or silica boat with approximate dimensions of length 25 mm, width 10 mm and height 10 mm shall be used to contain the sample.

Place a clean, dry boat in a small weighing bottle and fit a lid to it (see Fig. 1). Weigh to the nearest 0.1 mg, remove the boat and fill it with 0.2 g to 0.3 g of coal. Heat the boat in a nitrogen oven at 105°C to 110°C in accordance with AS 2434.7. On removing the boat from the oven, immediately place it back in the cold weighing bottle and fit the lid. Immediately reweigh

* In course of preparation.

† Kiss, L T, and King, T N, *Fuel*, 1977, *56*, 340; ibid, 1979, *58*, 547.