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METHODS FOR THE ANALYSIS AND TESTING OF COAL AND COKE

Part 5.1—GROSS SPECIFIC ENERGY OF COAL AND COKE—ADIABATIC CALORIMETERS

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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
Australian Institute of Energy
Bureau of Steel Manufacturers of Australia
Coal Preparation Society of N.S.W.
Coal Preparation Society of Queensland
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AUSTRALIAN STANDARD

METHODS FOR THE ANALYSIS AND TESTING OF COAL AND COKE

Part 5.1
GROSS SPECIFIC ENERGY OF COAL AND COKE—ADIABATIC CALORIMETERS

AS 1038.5.1—1988

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PREFACE

This Standard was prepared by the Association's Subcommittee on Coal Evaluation under the supervision of the Committee on Coal and Coke and the direction of the Minerals Standards Board, to supersede AS 1038.5—1979, *Methods for the analysis and testing of coal and coke*, Part 5: *Gross specific energy of coal and coke.*

Major alterations to the previous edition are as follows:

(a) AS 1038.5 has now been split as follows:

Part 5.1: *Gross specific energy of coal and coke—Adiabatic calorimeters*

Part 5.2: *Gross specific energy of coal and coke—Isothermal-type calorimeters.*

(b) Changes have been made to the procedure for the preparation of the barium hydroxide solution and the consequent change to the correction for the heat of formation of acids.

(c) Part 5.2 includes the use of waterless calorimeter systems.

(d) Part 5.2 includes calorimeter systems which employ automatic temperature monitoring and data computation.

The method is based closely on ISO 1928, *Solid mineral fuels—Determination of gross calorific value by the calorimeter bomb method, and calculation of net calorific value.* It differs from ISO 1928 in that it does not include the calculation of the net specific energy of the coal, which is described in AS 1038.16.

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STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard
METHODS FOR THE ANALYSIS AND TESTING OF COAL AND COKE

PART 5.1: GROSS SPECIFIC ENERGY OF COAL AND COKE—ADIABATIC CALORIMETERS

1 SCOPE. This Standard sets out a method for the determination of the gross specific energy of coal or coke, at constant volume, using a bomb calorimeter with an adiabatic water jacket.

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 (AS 1038.3)
- Part 4: Proximate analysis of coke (AS 1038.4)
- Part 6.1: Ultimate analysis of higher rank coal—Determination of carbon and hydrogen (AS 1038.6.1)
- Part 6.3: Ultimate analysis of higher rank coal—Determination of total sulphur (AS 1038.6.3)
- Part 7: Ultimate analysis of coke (AS 1038.7)
- Part 16: Acceptance and reporting of results (AS 1038.16)

1152 Test sieves

1210 Unfired pressure vessels

1349 Bourdon tube pressure and vacuum gauges

2243 Safety in laboratories

2418 Glossary of terms relating to solid mineral fuels

2646 Sampling of solid mineral fuels
- Part 6: Hard coal—Preparation of samples (AS 2646.6)
- Part 7: Coke—Preparation of samples (AS 2646.7)

2706 Numerical values—Rounding and interpretation of limiting values

BS
791 Specification for solid-stem calorimeter thermometers

4791 Specification for calorimeter bombs

3 DEFINITIONS. For the purpose of this Standard, the definitions given in AS 2418, and those below, apply.

3.1 Gross specific energy at constant volume—the number of heat units liberated when unit mass of solid fuel is burned in oxygen in a bomb under standard conditions. The materials after combustion are taken to consist of the gases oxygen, carbon dioxide, sulphur dioxide, nitrogen and oxides of nitrogen, liquid water (in equilibrium with its vapour and saturated with carbon dioxide) and solid ash.

3.2 Effective heat capacity of the system—the heat required to cause unit rise of temperature in the calorimeter system under the conditions of a calorimetric determination.

3.3 Repeatability (*r*)—the value at or below which the absolute difference between two single test results obtained with the same method on identical test material, under the same conditions (same operator, same apparatus, same laboratory, and the minimum practical time difference consistent with separate tests), may be expected to lie with a specified probability. In the absence of other specifications, the probability is 95 percent.

3.4 Reproducibility (*R*)—the value at or below which the absolute difference between two single test results obtained with the same method on identical material obtained by operators in different laboratories may be expected to lie with a specified probability. In the absence of other specifications, the probability is 95 per cent.

4 PRINCIPLE. A known mass of the sample is burned in oxygen in a bomb calorimeter under standard conditions. The gross specific energy is calculated from the rise in temperature of the water in the calorimeter vessel and the mean effective heat capacity of the system. Allowances are made for the heat released by the ignition fuse material for thermochemical corrections.

The international reference temperature for thermochemistry of 25°C is used as the reference temperature for specific energy, although the temperature dependence of the specific energy of coal or coke is small (about 1 J/g.K).

Full discussion of the principles involved in the determination of specific energy, the theoretical derivation of the corrections that have to be applied and the importance of the precautions that have to be taken are to be found in published papers.*

5 SAFETY. For information on laboratory safety, refer to the relevant parts of AS 2243.

6 REAGENTS.

6.1 General. Unless otherwise specified, all reagents shall be of recognized analytical quality, and distilled or deionized water shall be used throughout.

* Studies in bomb calorimetry I-XI, *Fuel* (London), *33* (1954) to *38* (1959). British Coke Research Association, '*Determination of the calorific value of coke*', Coke Research Report 9, Chesterfield, 1961, 12 pp.