Australian Standard™

Coal and coke—Analysis and testing

Part 22: Higher rank coal—Mineral matter and water of constitution

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Australasian Institute of Mining and Metallurgy

Australian Coal Association

Australian Coal Preparation Society

Australian Institute of Energy

Bureau of Steel Manufacturers of Australia

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Coalfield Geology Council of New South Wales

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PREFACE

This Standard was prepared by the Standards Australia Committee MN/1, Coal and Coke, to supersede AS 1038.22—1992.

This revision confirms the methods for the determination of mineral matter in coal and for the determination of water of constitution.

Editorial changes have been made to bring the Standard into line with current style.

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FOREWORD

The organic material of coal is associated with mineral and other inorganic matter that has been deposited or formed within the coal. These constituents provide the ash obtained on combustion of the coal; however, the mineral matter-to-ash ratios are variable between and within seams. Accordingly, the mineral matter content of coal should be known if coal analyses are to be converted to the dry, mineral matter-free basis (i.e. organic coal basis).

Methods of calculating the mineral matter of coal from the percentage ash and other analyses have been specified for British coals in BS 1016.100:1994, *Methods for analysis and testing of coal and coke*, Part 100: *General introduction and methods for reporting results*. These equations are derived from the mineral compositions and associations found in British coals and are not always appropriate for Australian coals*†‡.

ISO 602:1983, *Coal—Determination of mineral matter*, specifies a method for the direct determination of mineral matter using an acid demineralization procedure. The stated repeatability of this method is relatively poor, and figures for reproducibility are not given. Inherent in this determination is the necessity to make corrections for ash, insoluble pyrite and absorbed hydrochloric acid. Furthermore, the method may yield anomalous results on certain low rank coals§.

The direct determination of mineral matter (and associated water of constitution) in Australian coals has been investigated by Brown et al.**, who describe the following procedures for the determination of mineral matter:

(a) Air oxidation at 370°C of the coal substance.

(b) Acid demineralization similar to that specified in ISO 602.

(c) A combined procedure in which a hydrochloric acid extraction of carbonate, sulfate and phosphate minerals is followed by oxidation at 370°C.

Other methods for the determination of mineral matter are as follows:

(i) Low-temperature oxidation (at approximately 150°C) of the coal substance with a radio-frequency (RF) excited oxygen plasma§.

(ii) Low-temperature air oxidation at 370°C, with direct gravimetric determination of combined water**.

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* BROWN, H.R., DURIE, R.A. and SCHAFER, H.N.S. The inorganic constituents in Australian coals. I—The direct determination of the total mineral-matter content. Fuel, 1959, 38, 295-308.

† BROWN, H.R., DURIE, R.A. and SCHAFER, H.N.S. The inorganic constituents in Australian coals. II—Combined acid-digestion-low-temperature oxidation procedure for determination of total mineral-matter content, water of hydration of silicate minerals and composition of carbonate minerals. Fuel, 1960, 39, 59-70.

‡ BROWN, N.A., CALLCOTT, T.G., and KIROV, N.Y. Notes on mineral matter in Australian Coals. Paper A6, Symposium on Australian fuels and their utilization, Newcastle, N.S.W. August 1959. Published by the Australian Membership of the Institute of Fuel.

§ FRAZER, F.W. and BELCHER, C.B. Quantitative determination of the mineral-matter content of coal by a radiofrequency-oxidation technique. Fuel, 1973, 52, 41-46.

** BROWN, N.A., BELCHER, C.B. and CALLCOTT, T.G. Mineral matter in N.S.W. coke-making coals; composition, determination and effects. J. Inst. Fuel, 1965, 38, 198-206.