AS 2486—1989

Australian Standard®

Methods for microscopical determination of the reflectance of coal macerals

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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.
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Institution of Engineers, Australia
Joint Coal Board
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Queensland Coal Board
Royal Australian Chemical Institute
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PREFACE

This Standard was prepared by Standards Australia's Subcommittee on Coal Mining and Geology under the supervision of the Committee on Coal and Coke and the direction of the Minerals Standards Board to supersede AS 2486—1981. It is based on ISO 7404/5, *Methods for the petrographic analysis of bituminous coal and anthracite, Part 5: Method of determining microscopically the reflectance of vitrinite,* but has been expanded to include reference to the measurement of the reflectance of all coal macerals.

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FOREWORD

Most properties of a given coal are determined by the proportions and associations of the petrographic components present and by the rank of the coal. One property which can be used as a parameter of rank, independent of the petrographic composition, is the reflectance of the coal macerals which increases progressively with increasing degree of coalification. This Standard outlines methods specifically designed for the measurement of vitrinite reflectance. These methods are also applicable to the measurement of reflectance of other coal macerals.

In addition to its use in determining the rank of coal, vitrinite reflectance is measured for technological purposes such as determining the composition of coal blends and to help to predict the behaviour of a coal when processed. The procedure adopted for measuring vitrinite reflectance differs depending on the purpose for which the measurement is made. Therefore, in reporting the results it is important to specify which procedure was used.

As the vitrinite reflectance varies in a coal, it is necessary to ensure that a representative sample is prepared either as a series of vertical lump sections from a seam or more frequently as a particulate block, and that a sufficient number of measurements is made in accordance with an unbiased sampling procedure.

STANDARDS AUSTRALIA

Australian Standard

Methods for microscopical determination of the reflectance of coal macerals

1 SCOPE. This Standard sets out methods for the microscopical determination of the maximum and random reflectance in oil of polished surfaces of coal macerals. The methods are applicable to coal covering the whole rank range from brown coal to anthracite, and may be used for the following purposes:

(a) Exploration and preliminary assessment of coal quality.

(b) Technological purposes and quality control.

(c) Determination of thermal maturation index for petroleum exploration.

NOTES:

1. Reflectance measurements on coal macerals, obtained by interpreting the results of a computerized automated system of microscopic analysis, are outside the scope of this Standard.
2. If measurements are made in a medium other than oil, e.g. air, this should be stated.

2 REFERENCED DOCUMENTS. The following documents are referred to in this Standard:

AS

2061 Preparation of coal samples for incident light microscopy

2418 Glossary of terms relating to solid mineral fuels

2418.5 Part 5: Terms relating to the petrographic analysis of bituminous coal and anthracite (hard coal)

2856 Coal—Maceral analysis

3 DEFINITIONS. For the purpose of this Standard, the definitions given in AS 2418.5 and AS 2856, and those below, apply.

3.1 Repeatability of reflectance measurements—the absolute difference between the means of two sets of reflectance measurements, each based on the same number of observations, carried out within one laboratory on the same sample, within which 95 percent of such differences would be expected to lie.

3.2 Reproducibility of reflectance measurements—the absolute difference between the means of two sets of reflectance measurements, each based on the same number of observations, carried out in two different laboratories on different subsamples of the same sample, within which 95 percent of such differences would be expected to lie.

4 PRINCIPLE. The reflectance at near normal incidence of a specified area of the maceral under test is measured under oil immersion, using a photomultiplier, and is compared with reflectance measurements made under identical conditions on a set of standards of known reflectance.

Because different maceral particles within a single coal seam invariably differ slightly from one another in optical properties, a sufficient number of readings on different particles is taken to ensure that the results are representative.

5 MATERIALS.

5.1 Polished block. The polished block shall be prepared in accordance with AS 2061.

5.2 Immersion oil. The immersion oil shall be a non-fluorescent and non-corrosive type having a refractive index of 1.5180 ± 0.0004 when determined at 23°C and a wavelength of 546 nm. The temperature coefficient of the refractive index shall be less than 0.0005 per degree Celsius.

NOTE: Oil should not be used later than 1 year after the bottle was opened unless the refractive index has been checked and found to be within specification.

5.3 Calibration standards.

5.3.1 *Reflectance standards.* Reflectance standards shall consist of polished surfaces of materials which are—

(a) isotropic (or basal sections of uniaxial minerals);
(b) durable and resistant to corrosion;
(c) constant in reflectance over a long period;
(d) free from inclusions, grain boundaries, discontinuities, internal flaws and fractures; and
(e) low in absorptive index.

The reflectance of the standards shall be similar to the reflectance of the maceral to be measured, at least two such standards being used with well-spaced reflectances. For example, for measuring a reflectance of about 1.0 percent, standards with reflectances of approximately 0.6 percent, 1.0 percent and 1.6 percent should be used. If a maceral with reflectance greater than 2.0 percent is to be measured, then one or more additional standards with reflectance greater than 2.0 percent shall be used.

The reflectance standards shown in Table 1 are in common use.

NOTES:

1. Standards need careful cleaning to avoid scratching the polished surface. Tarnishing may also occur. When the surface becomes scratched or tarnished, or when comparison with the other standards shows that the reflectance value has changed, polishing is necessary.
2. To avoid significant amounts of light, other than that reflected from the top surface, returning to the objective, the body of the specimen should be either deeper than 5 mm or wedge-shaped, and the lower surface should be matt if it is parallel (or within 10 degrees) to the upper surface. The sides should be shielded from external light.

TABLE 1

COMMON REFLECTANCE STANDARDS

Designation	Refractive index	Reflectance (percent)*
Optical glasses	1.70 to 1.97	0.32 to 1.66
Synthetic spinel	1.73	0.42
Synthetic leucosapphire	1.77	0.59
Synthetic yttrium aluminium garnet (YAG)	1.84	0.92
Synthetic gadolinium gallium garnet (3G)	1.98	1.73
Diamond	2.42	5.28
Silicon carbide	2.66	7.50

* In oil of refractive index 1.518 at 23°C and a wavelength of 546 nm.