



Designation: D 5263 – 93<sup>ε1</sup>

## Standard Test Method for Determining the Relative Degree of Oxidation in Bituminous Coal by Alkali Extraction<sup>1</sup>

This standard is issued under the fixed designation D 5263; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

<sup>ε1</sup> NOTE—In 9.2, the value  $-2.36$  mm was editorially corrected to  $-250$   $\mu$ m in October 2000.

### 1. Scope

1.1 This colorimetric method describes the determination of the relative degree of oxidation by alkali extraction of coals that are high volatile A bituminous to low volatile bituminous in rank.

1.2 This test cannot be sensitive to thermally oxidized coal. It is intended for coals that may be oxidized as a result of weathering.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

1.4 The values stated in SI units shall be regarded as standard.

### 2. Referenced Documents

2.1 *ASTM Standards:*

D 1193 Specification for Reagent Water<sup>2</sup>

D 4621 Guide for Accountability and Quality Control in the Coal Analysis Laboratory<sup>3</sup>

### 3. Terminology

3.1 There are no terms in this standard that require new or other than dictionary definitions.

### 4. Summary of Test Method

4.1 Humic acids, which are present in oxidized coals, are extracted from the coal with sodium hydroxide solution. The degree of oxidation is determined by colorimetrically measuring the transmittance of the alkali extract solution at 520 nm. The intensity of the color produced by the humic acids is a function of the degree of oxidation.

### 5. Significance and Use

5.1 This test method is a relative measure of the degree of oxidation present in coal. It does not determine the quantitative amount of oxidized coal present. It is only intended to serve as a guide to the supplier, buyer, and user for selecting coals for metallurgical use.

NOTE 1—The values shown in Table 1 are based on the transmittance obtained using the original procedure<sup>4</sup> (wavelength at 520 nm, 17-mm light path, 2- to 3-min boiling time, dilution of the extract to 80 mL). At these conditions, coals that had transmittance values greater than 90 % were considered to be unoxidized, coals less than 80 % were considered to be oxidized, and coals between 80 and 90 % were considered suspect. As this procedure becomes accepted as the standard and more experimental data are gathered, modifications to these cutoff values are expected. Note that lower rank bituminous coals are more easily extracted than higher rank coal.

### 6. Apparatus

6.1 *Transmission Spectrophotometer*—Single-beam, grating spectrophotometer having a wavelength range of 340 to 900 nm.

6.2 *Glass Test Tubes/Cuvettes*, with light paths ranging from 10 to 17 mm may be used. Test tubes with an inside diameter of  $17 \pm 0.3$  mm are commonly used.

6.3 *Analytical Balance*, sensitive to 0.001 g.

6.4 *Hot Plate*, capable of bringing aqueous solutions to a boil.

6.5 *Thermometer*, capable of measuring up to 100°C with a sensitivity of  $\pm 0.5^\circ\text{C}$ .

6.6 *Filter Papers*, Type II, Class F and G.<sup>5</sup>

6.7 *Timer*, capable of measuring 30 min to the nearest second.

6.8 *Graduated Cylinder*, 100-mL capacity.

6.9 *Beakers*, 400-mL capacity.

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D-5 on Coal and Coke and is the direct responsibility of Subcommittee D05.15 on Metallurgical Properties of Coal and Coke.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 11.01.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 05.06.

<sup>4</sup> Lowenhaupt, D. E., and Gray, R. J., *International Journal of Coal Geology*, 1980, Vol 1, pp. 63–73.

<sup>5</sup> Whatman Grade Nos. 40 and 42 filter papers, or equivalent, have been found suitable for this purpose.