



Standard Test Method for Major and Minor Elements in Combustion Residues from Coal Utilization Processes¹

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1. Scope

1.1 This test method covers the analysis of the commonly determined major and minor elements in combustion residues from coal utilization processes.

NOTE 1—Test Methods D 1757 or D 5016 shall be used for determination of sulfur.

1.2 The values stated in SI units (Practice E 380) shall to be regarded as the standard.

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.*

2. Referenced Documents

2.1 ASTM Standards:

D 1193 Specification for Reagent Water²

D 1757 Test Method for Sulfate Sulfur in Ash from Coal and Coke³

D 2013 Method of Preparing Coal Samples for Analysis³

D 3173 Test Method for Moisture in the Analysis Sample of Coal and Coke³

D 3174 Test Method for Ash in the Analysis Sample of Coal and Coke from Coal³

D 3180 Practice for Calculating Coal and Coke Analyses from As-Determined to Different Bases³

D 5016 Test Method for Sulfur in Ash from Coal, Coke, and Residues from Coal Combustion Using High-Temperature Tube Furnace Combustion Method with Infrared Absorption³

D 5142 Test Methods for Proximate Analysis of the Analysis Sample of Coal and Coke by Instrumental Procedures³

E 691 Practice for Conducting an Interlaboratory Study to

Determine the Precision of a Test Method⁴

IEEE/ASTM SI 10 Standard for Use of the International System of Units (SI): The Modern Metric System⁴

3. Summary of Test Method

3.1 The combustion residue to be analyzed is ignited in air at 750°C to a constant weight. The ash is fused within lithium tetraborate ($\text{Li}_2\text{B}_4\text{O}_7$) followed by a final dissolution of the melt in either dilute hydrochloric acid (HCl) or dilute nitric acid (HNO_3). The solution is analyzed by atomic absorption/emission for applicable elements.

4. Significance and Use

4.1 A compositional analysis of the ash in coal is often useful in the total description of the quality of the coal. Knowledge of ash composition is also useful in predicting the behavior of ashes and slags in combustion chambers. Utilization of the ash by-products of coal combustion sometimes depends on the chemical composition of the ash.

4.2 Note that the chemical composition of laboratory-prepared coal ash may not exactly represent the composition of mineral matter in the coal or the composition of fly ash and slag resulting from commercial-scale burning of the coal.

5. Apparatus

5.1 *Ashing Furnace*, with an adequate air circulation and capable of having its temperature regulated between 700 and 750°C.

5.2 *Fusion Furnace*, with an operating temperature of 1000°C.

5.3 *Platinum Dish*, 35- to 85-mL capacity.

5.4 *Stirring Hotplate and Bars*, operating temperature of 200°C.

5.5 *Atomic Absorption Spectrometer*—Any dual-channel instrument using a deuterium (D_2) arc background corrector or other comparable simultaneous background correction system.

6. Reagents

6.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. It is intended that all reagents shall conform to

¹ This test method is under the jurisdiction of ASTM Committee D05 on Coal and Coke and is the direct responsibility of Subcommittee D 05.29 on Major Elements in Ash and Trace Elements of Coal.

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² *Annual Book of ASTM Standards*, Vol 11.01.

³ *Annual Book of ASTM Standards*, Vol 05.06.

⁴ *Annual Book of ASTM Standards*, Vol 14.04.