



Standard Test Method for Trace Elements in Coal and Coke Ash by Atomic Absorption¹

This standard is issued under the fixed designation D 3683; 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 (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method² describes a procedure for the determination of beryllium, chromium, copper, manganese, nickel, lead, vanadium, and zinc in coal ash or coke ash.

NOTE 1—Although not included, this test method can be applicable to the determination of other trace elements, for example, cadmium.

1.2 *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.*

1.3 The values stated in SI units (IEEE/ASTM SI 10) should be regarded as the standard.

2. Referenced Documents

2.1 ASTM Standards:

D 346 Practice for Collection and Preparation of Coke Samples For Laboratory Analysis³

D 1193 Specification for Reagent Water⁴

D 2013 Method of Preparing Coal Samples for Analysis³

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

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

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

IEEE/ASTM SI 10 Standard for Use of the International System of Units (SI): The Modern Metric System⁵

¹ This test method is under the jurisdiction of ASTM Committee D05 on Coal and Coke, and is the direct responsibility of Subcommittee D05.29 on Major Elements in Ash and Trace Elements in Coal.

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² For information concerning experimental work on which this test method is based, see Bernas, B., “A New Method for the Decomposition and Comprehensive Analysis of Silicates by Atomic Absorption Spectrometry,” *Analytical Chemistry*, ANCHA, Vol 40, 1968, pp 1682–86.

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

⁴ *Annual Book of ASTM Standards*, Vol 11.01.

⁵ *Annual Book of ASTM Standards*, Vol 14.04.

NOTE 2—Method D 2013 specifies coal ground to pass through a 60-mesh (250-μm) screen. For the trace element determinations in this test method –100-mesh (150-μm) coal is recommended.

3. Summary of Test Method

3.1 Coal or coke is ashed, the ash is dissolved by mineral acids, and the individual elements determined by atomic absorption spectrometry.

4. Significance and Use

4.1 Many trace elements occur in coal, primarily as a part of the mineral matter but may also be associated with the organic matrix. Concern over release of certain trace elements to the environment as a result of coal utilization has made the determination of these elements an increasingly important aspect of coal analysis.

4.2 When coal ash is prepared in accordance with this test method, the eight elements listed in 1.1 are quantitatively retained in the ash and are representative of concentrations in the coal. Concentrations of these and other elements in power plant ash, industrial process ash, fly ash, and so forth, may or may not be representative of total quantities in the coal.

5. Apparatus

5.1 *Atomic Absorption Spectrometer*—Any dual-channel instrument using a deuterium (D₂) arc background corrector or other comparable simultaneous background correction system.

5.2 *Muffle Furnace*, with temperature control.

5.3 *Bottles*, polyethylene or polytetrafluoroethylene, 125-mL capacity, with screw-cap lids, capable of withstanding temperatures up to 130°C.

5.4 *Volumetric Flasks*, 100-mL capacity.

5.5 *Steam Bath*.

5.6 *Analytical Balance*, capable of weighing to 0.1 mg.

5.7 *Crucibles*, 50-mL quartz or high silica.