



Designation: D 5016 – 03

# Standard Test Method for Sulfur in Ash from Coal, Coke, and Residues from Coal Combustion Using High-Temperature Tube Furnace Combustion Method with Infrared Absorption<sup>1</sup>

This standard is issued under the fixed designation D 5016; 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.

## 1. Scope

1.1 This test method describes a procedure using a high-temperature tube furnace and infrared detection for the rapid determination of sulfur in ash from coal and coke.

1.2 This test method is an alternative for test methods described in Test Methods D 1757.

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

1.4 *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 1757 Test Methods for Sulfur in Ash from Coal and Coke<sup>2</sup>

D 2795 Test Methods for Analysis of Coal and Coke Ash<sup>2</sup>

D 3174 Test Method for Ash in the Analysis Sample of Coal and Coke from Coal<sup>2</sup>

D 3682 Test Method for Major and Minor Elements in Coal and Coke Ash by Atomic Absorption<sup>2</sup>

D 4326 Test Method for Major and Minor Elements in Coal and Coke Ash by X-Ray Fluorescence<sup>2</sup>

D 4621 Guide for Accountability and Quality Control in the Coal Analysis Laboratory<sup>2</sup>

D 5142 Test Methods for Proximate Analysis of the Analysis Sample of Coal and Coke by Instrumental Procedures<sup>2</sup>

E 380 Practice for Use of the International System of Units (SI) (the Modernized Metric System)<sup>3</sup>

<sup>1</sup> 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 of Coal.

Current edition approved April 10, 2003. Published July 2003. Originally approved in 1989. Last previous edition approved 1998 as D 5016 – 98.

<sup>2</sup> Annual Book of ASTM Standards. Vol 05.05.

<sup>3</sup> Annual Book of ASTM Standards. Vol 14.02.

## 3. Summary of Test Method

3.1 A weighed test portion is mixed with a promoting agent and ignited in a tube furnace at a minimum operating temperature of 1350°C in a stream of oxygen (see Note 1). The combustible sulfur contained in the test portion is oxidized to gaseous oxides of sulfur. Moisture and particulates are removed by traps filled with anhydrous magnesium perchlorate. The gas stream is passed through a cell in which sulfur dioxide is measured by an infrared absorption detector. Sulfur dioxide absorbs IR energy at a precise wavelength within the IR spectrum. Energy is absorbed as the gas passes through the cell body in which the IR energy is being transmitted; thus, at the detector, less energy is received. All other IR energy is eliminated from reaching the detector by a precise wavelength filter. The absorption of IR energy can be attributed only to sulfur dioxide whose concentration is proportional to the change in energy at the detector. One cell is used as both a reference and a measurement chamber. Total sulfur as sulfur dioxide is detected on a continuous basis.

NOTE 1—The promoter aids in the quantitative release of all sulfur present in the test portion as SO<sub>2</sub>. Refer to the instrument manufacturer's recommended procedure for using oxidizing agents or promoters commonly referred to as "combustion accelerators."

3.2 This test method is applicable for use with commercially available sulfur analyzers equipped to carry out the operations in 3.1 automatically, and must be calibrated using certified reference materials (CRM's) covering the range of sulfur in the ash samples being analyzed.

## 4. Significance and Use

4.1 The purpose of this test method is to determine the percent sulfur trioxide (SO<sub>3</sub>) portion of the major and minor elements in coal ash.

4.2 This test method may be used to determine the percent sulfur trioxide (SO<sub>3</sub>) portion of ash determined by Test Methods D 3174 or D 5142 for coals containing high amounts of calcium. The ash may then be reported on a sulfur trioxide free basis.