Designation: D5003 – 06a (Reapproved 2011)

Standard Test Method for Hardgrove Grindability Index (HGI) of Petroleum Coke[1]

This standard is issued under the fixed designation D5003; 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.

INTRODUCTION

Introduction of petroleum coke into the coal market in recent years has necessitated the use of many of the test methods for coal so like data would be available for comparison and blending purposes. Test Method D409 does not cover petroleum coke in its scope and its statements of precision and bias do not include petroleum coke. This test method provides the procedures and precision and bias data for the hardgrove grindability index (HGI) of petroleum coke. Use of this test method or Test Method D409 produces the same value for the sample of petroleum coke being analyzed.

1. Scope

1.1 This test method covers the determination of the hardgrove grindability index (HGI) of those petroleum cokes that contain no dedusting additive. The procedure for this test method is the same as in Test Method D409. Sections of this test method contain the significance and use of the HGI of petroleum coke, preliminary sample preparation procedures, and procedure and precision and bias data specific to petroleum coke.

NOTE 1—The size consistency (particle size distribution) of fluid petroleum coke is generally 100 % passing a 6.73 mm (No. 3) sieve and greater than 80 % passing a 2.00 mm (No. 10) sieve. Much of fluid cokes will pass a 0.59 mm (No. 30) sieve. Because of this fineness the HGI value is related to the coarser particles in fluid coke and large samples are required to prepare sufficient material of the correct particle size for Test Method D409.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.2.1 *Exception*—Hardgrove grindability index is unitless.

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:*[2]

D409 Test Method for Grindability of Coal by the Hardgrove-Machine Method

D4930 Test Method for Dust Control Material on Calcined Petroleum Coke

3. Terminology

3.1 *Definitions:*

3.1.1 *calcined petroleum coke, n*—petroleum coke that has been thermally treated to drive off the volatile matter and to develop crystalline structure.

3.1.2 *fluid coke, n*—petroleum coke with a granular, microscopic layered structure resulting from injection of petroleum feedstock into a flowing, loose bed of coke particles.

3.1.3 *Hardgrove Grindability Index, HGI, unitless, n—in petroleum coke technology*, measurement of the relative ease of pulverizing a raw petroleum coke or green petroleum coke in comparison with coal standards. The higher the HGI value, the easier the petroleum coke is to grind.

3.1.4 *petroleum coke, n*—solid, carbonaceous residue produced by thermal decomposition of heavy petroleum fractions or cracked stocks, or both.

3.1.5 *raw petroleum coke, n*—petroleum coke that has not been calcined.

[1] This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.05 on Properties of Fuels, Petroleum Coke and Carbon Material.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

4. Summary of Test Method

4.1 The sample of petroleum coke is reduced (crushed) to produce a high yield of particles passing a 1.19 mm (No. 16) sieve and retained on a 0.59 mm (No. 30) sieve. These particles are reduced in the hardgrove grindability machine according to Test Method D409. The quantity of particles retained on a 0.074 mm (No. 200) sieve is used to calculate the HGI of the sample.

5. Significance and Use

5.1 The HGI is used to predict the ranking of raw petroleum cokes or calcined petroleum cokes in industrial size mills used for crushing operations. The rankings are based on energy required and feed rate or both.

5.2 The HGI is also used to select raw petroleum cokes and coals that are compatible with each other when milled together in a blend so that segregation of the blend does not occur during particle size reduction.

6. Hazards

6.1 Calcined petroleum coke is generally coated with a dedusting agent to decrease the occurrence and the quantity of dust during subsequent transporting of the calcined petroleum coke. The dedusting agent is an oil or suitable material. When a dedusting agent is present and is not removed prior to the determination of HGI there can be interference in the sieving step to measure the portions retained on and passing a 0.074 mm (No. 200) sieve. Removal of the dedusting agent after calcined petroleum coke is reduced to pass the 4.76 mm (No. 4) sieve and before stage crushing to pass the 1.19 mm (No. 16) sieve is required. Suitable solvents for oil removal are dichloromethane, dichloroethane and toluene. (**Warning—**See the appropriate materials safety data sheet.) The solvent used must be removed prior to the reduction to pass the 1.19 mm (No. 16) sieve. Heating to 10°C above the boiling point of the solvent used or application of vacuum is satisfactory for the removal.

7. Sampling and Sample Preparation

7.1 A guide for sampling petroleum cokes and calcined coke[3] and a practice for preparing samples of petroleum coke are in the ASTM process of development and will be referenced when they are available. The sample preparation in Test Method D409 is adequate.

7.2 When a dedusting agent is present remove it in the manner required by the supplier of the calcined petroleum coke. The supplier knows what the added agent is, and should best know how to remove it. See Test Method D4930.

8. Procedure

8.1 The procedure (including apparatus) for raw petroleum coke and for calcined petroleum coke having no dedusting agent is the same as listed in Test Method D409.

9. Precision and Bias

9.1 *Precision*—The statements for repeatability and reproducibility for petroleum coke and calcined petroleum coke are being developed following RR:D02-1007.[4]

9.2 *Bias*—The procedure in this test method has no bias because the value of the hardgrove grindability index can be defined only in terms of the test method.

10. Keywords

10.1 coke; grindability; petroleum coke

[3] The guide and practice are being developed by ASTM Committee D02 on Petroleum Products and Lubricants.

[4] Filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:D02-1007.

ANNEX

(Mandatory Information)

A1. TEST METHOD D409

A1.1 Test Method D409 is under the jurisdiction of ASTM Committee D05 on Coal and Coke. Committee D02 follows all revisions and modifications of Test Method D409 through liaison contact with Committee D05. ASTM Committee D02 will revise other sections of this test method when necessary to conform to changes in Test Method D409.