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Standard Guide for Sampling Plan and Core Sampling of Carbon Cathode Blocks Used in Aluminum Production[1]

This standard is issued under the fixed designation D6354; 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 guide covers sampling of carbon cathode blocks used in the production of aluminum, and details procedures for taking samples from single cathode blocks. It covers equipment and procedures for obtaining samples from cathode blocks in a manner that does not destroy the cathode block or prevent its subsequent use as originally intended. However, the user must determine the subsequent use of the sampled cathode blocks. Preferred locations for taking samples from single units of cathode blocks are covered in this guide.

1.1.1 Information for sampling of shaped refractory products, in general, is given in ISO 5022. This standard details the statistical basis for sampling plans for acceptance testing of a consignment or lot. Cathode blocks used in the production of aluminum have specific requirements of sampling, and while the statistical basis for sampling given in ISO 5022 applies, further or modified requirements may also apply.

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

NOTE 1—The following ASTM standards are noted as sources of useful information: Test Methods C559, C611, C651, C747, C1025, C1039, and C1225.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C559 Test Method for Bulk Density by Physical Measurements of Manufactured Carbon and Graphite Articles

C611 Test Method for Electrical Resistivity of Manufactured Carbon and Graphite Articles at Room Temperature

C651 Test Method for Flexural Strength of Manufactured Carbon and Graphite Articles Using Four-Point Loading at Room Temperature

C747 Test Method for Moduli of Elasticity and Fundamental Frequencies of Carbon and Graphite Materials by Sonic Resonance

C1025 Test Method for Modulus of Rupture in Bending of Electrode Graphite

C1039 Test Methods for Apparent Porosity, Apparent Specific Gravity, and Bulk Density of Graphite Electrodes

C1225 Specification for Fiber-Cement Roofing Shingles, Shakes, and Slates

D4175 Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants

2.2 *ISO Standards:*[3]

ISO 8007-1 Carbonaceous materials used in the production of aluminum - Cathodic blocks - Sampling plan and sampling from single cathodic blocks

ISO 5022 Shaped refractory products - Sampling and acceptance testing

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in this guide, refer to Terminology D4175.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *cathode block, n*—one manufactured unit used as a negative carbon electrode.

3.2.2 *sample, n*—a portion of carbon obtained from a cathode block.

[1] This guide is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, 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.

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

***A Summary of Changes section appears at the end of this standard**

3.2.3 *specimen, n*—a piece or portion of a sample used to make a test.

4. Significance and Use

4.1 Core sampling is an acceptable way of obtaining a test specimen without destroying the usefulness of a cathode block.

4.1.1 Test specimens obtained by this guide can be used by producers and users of cathode blocks for the purpose of conducting the tests in Note 1 to obtain comparative physical properties.

4.2 Sampling shall not weaken the cathode block or increase the likelihood of premature failure. Extreme care shall be exercised when taking vertically drilled samples.

5. Apparatus

5.1 *Core Drill Bit,* similar to that shown in Fig. 1, driven by suitable equipment. Use bits with cutting teeth coated with diamond or other extremely hard material.

6. Procedure

6.1 Sampling locations for cathode blocks that were vibrated, pressed, or extruded without a collector bar slot will differ from those cathode blocks that were formed with collector bar slots.

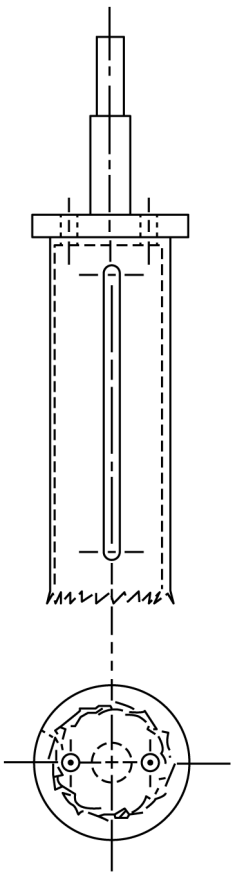

FIG. 1 Typical Core Drill Bit

6.1.1 For cathode blocks without collector bar slots, samples shall be drilled from the part of the cathode block that will be machined out for the slot, as shown in Fig. 2. Care is to be taken to ensure that cores drilled vertical to the slot do not penetrate beyond the depth of the slot.

6.1.2 For cathode blocks with collector bar slots, samples shall be drilled from the cathode block, as shown in Fig. 3. If the user determines that cathode blocks with sample holes drilled in them cannot be used in the electrolysis process, then it will be necessary to obtain a number of cathode blocks with the extra length, as shown in Fig. 3. The extra length will then have to be removed prior to cathode block use.

6.2 Dimensions of a cored sample will depend upon the test that is to be performed on the sample. The minimum dimension (usually the diameter) shall be at least three times the maximum particle size of the dry aggregate used in the manufacture of the cathode block. Reference should be made to the standards relating to the tests to be performed to ensure that the samples taken are to suitable dimensions.

6.2.1 The specific dimensions of the test specimens to be tested are normally given in the appropriate ASTM standard. Where a standard does not specify the dimensions of the test specimen, a diameter of 30 mm or 50 mm is recommended. The length of the test specimens should be at least one and a half times the diameter.

6.3 Place the core drill bit firmly against the cathode block. Take care to maintain the bit level and true. Do not stop until the bit is embedded its full length. Compressed air can be used to cool the drill bit and remove dust while drilling. Do not use water or other liquids to cool the drill bit.

6.3.1 To remove the bit, pull and twist it by hand, or carefully withdraw the drill bit while it is rotating. To remove the sample, insert a wedge between it and the cathode block until the core snaps.

7. Report

7.1 The sampling report shall include the following:

7.1.1 Names of producer and customer,

7.1.2 Manufacturer's identification of the lot or batch of cathode blocks being sampled,

7.1.3 Reference to this guide,

7.1.4 Date and place of sampling,

7.1.5 If extra length cathode blocks were available for sampling, the proportion and number are to be noted,

7.1.6 Sketches, similar to those in Fig. 2 and Fig. 3, showing the location of the sampling locations and the direction of sampling (horizontally or vertically),

7.1.7 The dimensions of the samples,

7.1.8 Identification of the people doing the sampling, and

7.1.9 Complete details of sampling plan being followed.

8. Keywords

8.1 anthracite; carbon; cathodes; core; graphite; sample; sampling; test specimens