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Standard Practice for Disintegration of Carbon Refractories by Alkali[1]

This standard is issued under the fixed designation C 454; 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 practice shows the behavior of carbon refractories when subjected to the action of an alkali at an elevated temperature. This destructive condition as encountered in service is accelerated in the test to show in a short time the probable behavior of the carbon refractory during use.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are provided for information only.

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. Significance and Use

2.1 The disintegration of carbon refractories by alkali attack at elevated temperatures is an important consideration in using these materials for certain applications. Disruption of carbon refractories in the test is sensitive to a number of variables, including alkali concentration, temperature, and the presence of water vapor. The procedure is suitable for guidance in product development and for relative comparisons in application work such as in blast furnace service.

3. Apparatus and Materials

3.1 *Sagger*— A sagger, and coke breeze passing a No. 4 (4.75-mm) sieve.

3.2 *Kiln*—The kiln shall be capable of maintaining the specified rate of heating. During the temperature holding period, the temperature distribution over the hearth shall not vary more than ±15°F (8°C).

3.3 *Potassium Carbonate* (K_2CO_3)—Anhydrous granular.

4. Test Specimens

4.1 Ten specimens constitute a specimen set and not more than one specimen is taken from a given carbon shape.

4.2 Two-inch (51-mm) cube specimens are cut from the shapes to a manner so as to maintain as many of the original surfaces as possible.

4.3 A hole ⅞ in. (22 mm) in diameter and 1 in. (25 mm) deep is drilled into the center of one face of each specimen.

4.4 Cut a lid from a carbon shape measuring approximately 2 by 2 by ¼ in. (50 by 50 by 6 mm) for each specimen.

5. Procedure

5.1 Dry the specimens and lids at 220 to 230°F (105 to 110°C) for at least 1 h. Place 8 g of K_2CO_3 in the hole of each specimen, and then place a lid over each hole.

5.2 Place the prepared specimens in the sagger, using coke breeze as a packing material to prevent oxidation. Maintain a distance of not less than 1 in. (25 mm) between the inner wall of the sagger and any specimen, and not less than ¼ in. (6 mm) between specimens. Cover the uppermost specimen with a layer of coke breeze at least 1 in. in thickness and place a close-fitting cover on the sagger. The lid may be sealed in place around the outside of the sagger by the use of air-setting refractory mortar.

5.3 Heat the sagger assembly in the kiln at a rate not exceeding 360°F (200°C)/h until 1750°F (955°C) is reached; maintain that temperature within ±15°F (8.5°C) for 5 h.

5.4 During the cooling period, remove the specimens from the sagger before they reach 210°F (100°C) and store, until examined and photographed, in a desiccator or drying oven operating at 220 to 230°F (105 to 110°C).

NOTE 1—If there is a delay between preparing (5.1) and heating (5.3) the specimens, store them or the sagger-specimen assemblage in a desiccator or in an oven maintained at 220 to 230°F (105 to 110°C) until the procedure is continued.

6. Report

6.1 Report the condition of each test specimen upon being removed from the sagger, and attach a photograph to the written report. The photograph shall show the top and two sides of each specimen at not less than half their actual size.

6.2 Use the following classification in reporting the condition of the specimens:

6.2.1 *Unaffected (U)*, no visible cracks,

6.2.2 *Lightly Cracked (LC)*, hairline cracks,

6.2.3 *Cracked (C)*, cracks greater than 1⁄64 in. (0.4 mm) wide, or

[1] This practice is under the jurisdiction of ASTM Committee C-8 on Refractories and is the direct responsibility of Subcommittee C08.07 on Alumina, Silica, and Special Refractories.

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6.2.4 *Disintegrated (D)*, broken into two or more pieces.

6.3 Type of heat source, kiln, and muffling.

7. Precision and Bias

7.1 *Precision*— No justifiable statement on precision can be made since the results of the test are reported by descriptions and photographs, and the degree of variability cannot be established.

7.2 *Bias*—No justifiable statement on bias can be made since the true or standard value for the degree of disintegration cannot be established by an accepted reference method.

8. Keywords

8.1 alkali; carbon refractories; disintegration