Designation: C1171 – 16

Standard Test Method for Quantitatively Measuring the Effect of Thermal Shock and Thermal Cycling on Refractories[1]

This standard is issued under the fixed designation C1171; 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 method is used for determining the strength loss or reduction in continuity, or both, of prism-shaped specimens which are cut from refractory brick or shapes and subjected to thermal cycling.

1.2 The strength loss is measured by the difference in modulus of rupture (MOR) between uncycled specimens and the specimens subjected to thermal cycling.

1.3 The reduction in structural continuity is estimated by the difference in sonic velocity before and after thermal cycling.

1.4 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.5 *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]

C133 Test Methods for Cold Crushing Strength and Modulus of Rupture of Refractories

C607 Practice for Coking Large Shapes of Carbon-Bearing Materials

C1419 Test Method for Sonic Velocity in Refractory Materials at Room Temperature and Its Use in Obtaining an Approximate Young's Modulus

E4 Practices for Force Verification of Testing Machines

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Significance and Use

3.1 This test method indicates the ability of a refractory product to withstand the stress generated by sudden changes in temperature.

3.2 Because the recommended furnace temperature of this cycling test is 1200°C (2190°F), this test method may not indicate the ability of a refractory product to withstand cycling at higher or lower temperatures, especially if the existing morphology of the refractory product changes.

3.3 This test method is useful for research and development, as well as for comparing refractory products. The precision should be considered when using this test for specification purposes.

3.4 Ruggedness tests found the following variables to be rugged:

temperature	+5°C
hot spacing	½ to ¾ in. (12.77 to 19 mm)
cold spacing	½ to ¾ in. (12.77 to 19 mm)
center vs. end gripping of the bars	
hot hold time	10 to 15 min
cold hold time	10 to 15 min
operator air speed	0 to 2 mi/h (0 to 3.2 km/h)
initially cold or heated samples	
last in, first out (LIFO); or first in, first out (FIFO) removal from the furnace	
sawed or original surface as tensile face during MOR testing	
bar thickness	0.96 to 1.04 in. (24.5 to 26.4 mm)

4. Apparatus

4.1 *Furnace,* capable of maintaining 1200°C (2190°F) with recovery rate of less than 5 min to temperature.

4.2 *Abrasive Saw,* to cut the test specimens.

4.3 *Dryer,* capable of operating at 105°C to 110°C (220°F to 230°F).

4.4 *Tongs or Fork,* for handling hot specimens.

4.5 *Safety Equipment,* such as gloves, face shields, and tinted safety glasses.

4.6 *Alumina Setter Brick,* 90 %, placed 5 in. (127 mm) apart in and outside the furnace.

[1] This test method is under the jurisdiction of ASTM Committee C08 on Refractories and is the direct responsibility of Subcommittee C08.02 on Thermal Properties.

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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.