ASTM C704 Test Variability Reduced to Allow Further Optimization of Erosion-resistant Refractories for Critical Oil Refining Applications

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Contents

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1 Scope

1.1 This technical report documents the results of a joint project conducted by the API CRE Subcommittee on Refractory Materials (SCRM) and the ASTM C08 Committee to improve the reproducibility of the ASTM C704/C704M, 2015 Edition, *Standard Test Method for Abrasion Resistance of Refractory Materials at Room Temperature*. Erosion-resistant refractories are used in many oil refining applications, such as fluid catalytic cracking units (FCCUs), to resist the wearing effects of solids particles (5 µm to 100 µm is typical) circulating at elevated velocities [30 ft/s to 200 ft/s (9 m/s to 61 m/s)] in a high-temperature process environment [900 °F to 1400 °F (482 °C to 760 °C)].

1.2 This technical report also reviews the drivers for continuing improvement in erosion-resistant refractories and the role of ASTM C704/C704M for the selection and installation quality control of refractories used in these installations. This report documents changes made to the setup and procedures to improve the reproducibility of the test. These changes are designed to achieve this end, while providing a rough equivalency consistent with historical data before the changes were made. These results are validated by extensive international round robin and ruggedness testing and are reported herein.

2 Referenced Documents

API 936, *Refractory Installation Quality Control—Inspection and Testing, Monolithic Refractory Linings and Materials* (2014)

API TR 978, *Monolithic Refractories: Manufacture, Properties, and Selection*

API TR 979, *Applications of Refractory Lining Materials*

API TR 980, *Monolithic Refractories: Installation and Dryout*

ASTM C704/C704M [1], *Standard Test Method for Abrasion Resistance of Refractory Materials at Room Temperature* (2015).

ASTM C1036, *Standard Specification for Flat Glass*

ASTM E691-09, *Standard Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method*

3 Terms and Definitions

3.1
abrasion resistance
The ability to withstand the effects of eroding particles for an extended period without the significant loss of material or other damage. Often referred to as “erosion resistance” in fluid solids units, such as FCC units, which is technically incorrect, but commonly understood in refining jargon.

EXAMPLE Ability of a refractory lining in an FCCU transfer line to retain thickness when exposed to circulating catalyst in the process stream.

NOTE For refractory materials, abrasion resistance is measured in the form of eroded volume loss in accordance with ASTM C704/C704M.

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[1] ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, Pennsylvania, 19428-2959.