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Refractory products — Determination of compressive strength at elevated temperature

Produits réfractaires — Détermination de la résistance à la compression à température élevée

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 33, *Refractories.*

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Refractory products — Determination of compressive strength at elevated temperature

1 Scope

This document specifies a test method for determining the compressive strength of refractory products at elevated temperature.

This test method could also be used for materials development, quality control, characterization, design and data generation purposes.

NOTE This document also could be used for determining the compressive strength of carbon containing refractory products at elevated temperature in an airtight furnace with reducing atmosphere.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 5022, *Shaped refractory products — Sampling and acceptance testing*

ISO 1927-2, *Monolithic (unshaped) refractory products — Part 2: Sampling for testing*

ISO 1927-5, *Monolithic (unshaped) refractory products — Part 5: Preparation and treatment of test pieces*

ISO 8895, *Shaped insulating refractory products — Determination of cold crushing strength*

ISO 10059-1, *Dense, shaped refractory products — Determination of cold compressive strength — Part 1: Referee test without packing*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
compressive strength at elevated temperature
maximum load (applied under specified conditions at elevated temperature) divided by the area over which the load is applied, that a refractory will withstand before failure occurs

4 Principle

A test piece of known dimension is subjected, at test temperature and under specified conditions, to an increasing compressive load until failure occurs (fracture occurs, or strain reaches 1 % for dense refractory products or 10 % for shaped insulating refractory products, respectively). The compressive strength at elevated temperature is calculated from the maximum load that a refractory will withstand before failure occurs and the mean cross-sectional area over which the load is applied.

NOTE The unit of compressive strength at elevated temperature is N/mm^2 (MPa).

5 Apparatus

5.1 Furnace

5.1.1 The furnace shall be able to heat the test piece to the setting temperature with a constant heating rate. The temperature deviation shall be less than 20 °C while the test temperature is above 500 °C.

5.1.2 The hot end of the thermocouple should be located at the middle of the test piece. The distance between the test piece and the hot end of the thermocouple should be less than 10 mm.

The furnace design should be such that the test pieces and columns can be easily installed.

5.2 Loading device

5.2.1 General

The capacity of the test machine shall be greater than 10 % of the expected load at fracture or the maximum load before the strain reaches the expected value. The accuracy of the load measurement exerted on the test piece should be within 2 %. The test machine shall be capable of applying loads with a constant stress rate meeting the requirements of 7.4.1 for dense shaped refractory products or 7.4.2 for insulating refractory products and recording the load-strain curve.

5.2.2 Loading column

The loading column shall be a cylinder at least 60 mm in diameter, or a rectangular column at least 60 mm in side length. The loading column sits on a spherical seating material that will compensate for small deviations from parallelism between the columns and the test piece. The loading column shall be capable of withstanding the applied load up to the end of test.

5.2.3 Supporting column

The supporting column shall be a cylinder at least 60 mm in diameter, or a rectangular column at least 60 mm in side length. The supporting column shall be capable of withstanding the applied load up to the end of test.

5.2.4 Discs

a) The discs shall be placed between the columns and test piece to prevent a possible reaction between their components.

b) The discs shall be made of a suitable refractory material compatible with the material under test. (e.g. high-fired mullite or alumina for alumina-silicate products, and magnesia or spinel for magnesia products).

c) The discs shall be capable of withstanding the applied load up to the end of test.

d) The diameter or side length shall be about 5 mm longer than that of column and the thickness shall be approximately 30 mm to 50 mm.

5.3 Deformation measuring device

It shall be capable of measuring and recording the deformation of test pieces when loading. An appropriate measuring instrument, such as dial-gauge or a length transducer, could be used only if its sensitivity is better than 0,005 mm.