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Dense shaped refractory products — Determination of resistance to sulfuric acid

Produits réfractaires façonnés denses — Détermination de la résistance à l'acide sulfurique

Reference number
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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 8890 was prepared by Technical Committee ISO/TC 33, *Refractories.*

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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Dense shaped refractory products — Determination of resistance to sulfuric acid

1 Scope and field of application

This International Standard specifies a method for determining the resistance of dense shaped refractory products to attack by sulfuric acid.

NOTE — Sulfuric acid is used since it gives results which are typical of the results of exposing refractory materials to many acids other than hydrofluoric acid.

2 References

ISO 383, *Laboratory glassware — Interchangeable conical ground joints.*

ISO 565, *Test sieves — Woven metal wire cloth and perforated plate — Nominal sizes of apertures.*

ISO 1770, *Solid-stem general purpose thermometers.*

ISO 1773, *Laboratory glassware — Boiling flasks (narrow-necked).*

ISO 4799, *Laboratory glassware — Condensers.*

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

3 Principle

The test sample, crushed in a specified manner, is subjected for 6 h to attack by 70 % (m/m) boiling sulfuric acid, and the resultant mass loss is determined and expressed as a percentage of the initial mass of the dry material.

4 Apparatus

Ordinary laboratory apparatus and

4.1 Suitable mechanical crushing device, preferably not steel.

4.2 Woven metal wire cloth sieve, 0,80 mm aperture, conforming to the requirements of ISO 565 (supplementary size list).

4.3 Woven metal wire cloth sieve, 0,63 mm aperture, conforming to the requirements of ISO 565 (supplementary size list).

4.4 Balance, capable of weighing 25 g to the nearest 0,001 g.

4.5 Round-bottomed flasks, of capacity 500 ml (see ISO 1773), each with a short, narrow neck, equipped with a ground glass stopper (see ISO 383) for the insertion of a thermometer.

4.6 Coil condensers, of length 250 mm, having at least 16 turns in the coil (see ISO 4799).

4.7 Immersion thermometers (length approximately 110 mm) (see ISO 1770).

4.8 Sand bath or **oil bath.**

4.9 Porcelain filter crucible.

4.10 Thermostatically controlled oven, capable of maintaining a temperature of 110 ± 5 °C.

5 Reagents

During the test, use only reagents of recognized analytical grade and only distilled water or water of equivalent purity.

5.1 Sulfuric acid, 70 % (m/m), ϱ_{15} = 1,615 g/cm³.

5.2 Barium chloride, 50 g/l solution.

6 Test samples

6.1 The number of samples to be taken shall be in accordance with ISO 5022 or with another standard sampling plan.

6.2 From each sample, take two pieces of a total mass of approximately 250 g, one from the centre and one from an edge.

6.3 Grind the two pieces together using the crushing device (4.1), sieving the material several times and re-grinding the residues until all the test material has passed through the 0,80 mm aperture sieve (4.2).

NOTE — The material of the mortar should be harder than the test material. If a steel mortar has to be used, treat the crushed material carefully with a magnet.

6.4 Sieve the material through the 0,63 mm aperture sieve (4.3). Clear the residue on the sieve of all dust particles by washing with distilled water. This residue forms the test material.

NOTE — A systematic error will be introduced if grain sizes are used other than between the limits set in 6.3 and 6.4.

6.5 Dry the residue on the 0,63 mm aperture sieve in the oven (4.10), controlled at 110 ± 5 °C, until constant mass is reached. Before each weighing, allow the sieve with contents to cool to ambient temperature in a desiccator. Weigh to the nearest ± 0,001 g.

7 Procedure

7.1 It is advisable to carry out at least two tests in parallel.

7.2 For each test, weigh, to the nearest 0,001 g, about 20 g of the dried material (mass m_1).

7.3 Place the weighed test material in a round-bottomed flask (4.5) and cover it with 200 ml of the sulfuric acid (5.1). Attach a coil condenser (4.6) and insert a thermometer (4.7) so that it is immersed at least 15 mm in the liquid.

7.4 Over a period of about 30 min, bring the contents of the flask to the boiling point in the sand or oil bath (4.8) [the boiling point of 70 % (m/m) sulfuric acid is approximately 170 °C]. Note the temperature of the liquid after boiling has begun.

7.5 Keep the liquid boiling lightly for a period of 6 h. Note the temperature of the liquid at the end of this time.

7.6 After the liquid has boiled for 6 h, take the flask out of the bath and allow it to cool for 1 h. Decant the clear acid floating on top of the sample. Cautiously pour in approximately 500 ml of distilled water, and wash the whole contents of the flask into the porcelain filter crucible (4.9), previously dried and weighed to the nearest 0,001 g, using an aspirator to aid filtering. Wash the residue in the filter crucible with distilled water until the filtrate remains unclouded when a few drops of the barium chloride solution (5.2) are added.

7.7 Dry the crucible containing the residue in the oven, controlled at 110 ± 5 °C, until constant mass is reached. Before each weighing, allow the crucible and its contents to cool to ambient temperature in a desiccator.

Weigh the crucible and its contents to the nearest 0,001 g (the net mass is m_2).

8 Expression of results

Calculate the loss of mass of the test material, as a percentage of its initial mass, using the formula

$$\frac{m_1 - m_2}{m_1} \times 100$$

where

m_1 is the initial mass, in grams, of the test material;

m_2 is the mass, in grams, of the residue.

9 Test report

The test report shall include the following information:

a) the testing establishment;

b) the date of the test;

c) a reference to this International Standard, i.e. "Determination of resistance to acids in accordance with ISO 8890";

d) the material tested (manufacturer, type, batch number, etc.);

e) the temperature of the acid shortly after boiling began and shortly before the end of the test;

f) the individual values and the calculated mean value of the proportionate loss of mass of each sample tested.

NOTE — The individual values are used in determining the mean value. The mean value is used in further statistical analysis, for example in accordance with ISO 5022.

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