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Fine ceramics (advanced ceramics, advanced technical ceramics) — Determination of flowability of ceramic powders

Céramiques techniques — Détermination de l'aptitude à l'écoulement des poudres céramiques

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 14629 was prepared by Technical Committee ISO/TC 206, *Fine ceramics*.

Fine ceramics (advanced ceramics, advanced technical ceramics) — Determination of flowability of ceramic powders

1 Scope

This International Standard specifies a test method to determine the flowability of granulated or ungranulated ceramic powders by means of a specified funnel. The method is applicable only to powders which flow freely through the specified test orifice.

2 Normative references

The following referenced documents are indispensable for the application 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 565, *Test sieves — Metal wire cloth, perforated metal plate and electroformed sheet — Nominal sizes of openings*

ISO 80000-1, *Quantities and units — Part 1: General*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

3 Principle

The flow time required for approximately 50,0 g of ceramic powder to flow through the orifice of a funnel having specified dimensions is determined. The mass of the powder divided by its flow time gives its flow rate, i.e. flowability.

4 Apparatus

4.1 Funnel

A stainless-steel funnel (Figure 1) having an orifice of diameter 2,5 mm and another funnel with an orifice of diameter 5,0 mm. The funnel shall be made of a non-magnetic, corrosion-resistant metallic material such as stainless steel (for example SUS 304) having sufficient wall thickness and hardness to withstand distortion and excessive wear.

4.2 Container

A stainless-steel container large enough to collect all of the ceramic powders discharged from the orifice of a funnel, e.g. as indicated in Figure 2.

4.3 Stand and horizontal vibration-free base

A stand to support the funnel concentric with the container so that the bottom of the funnel orifice is approximately 50 mm above the top of the container when the apparatus is assembled as shown in Figure 3.

4.4 Sieve

A sieve, as specified in ISO 565, with an aperture size of 0,71 mm.

4.5 Balance

A balance capable of weighing to the nearest 0,1 g or 0,01 g.

NOTE A balance capable of weighing to the nearest 0,01 g should be used for very fluffy powders such as aerosil (fumed silica).

4.6 Stopwatch

A stopwatch capable of measuring the elapsed time to the nearest 0,1 s.

4.7 Glove

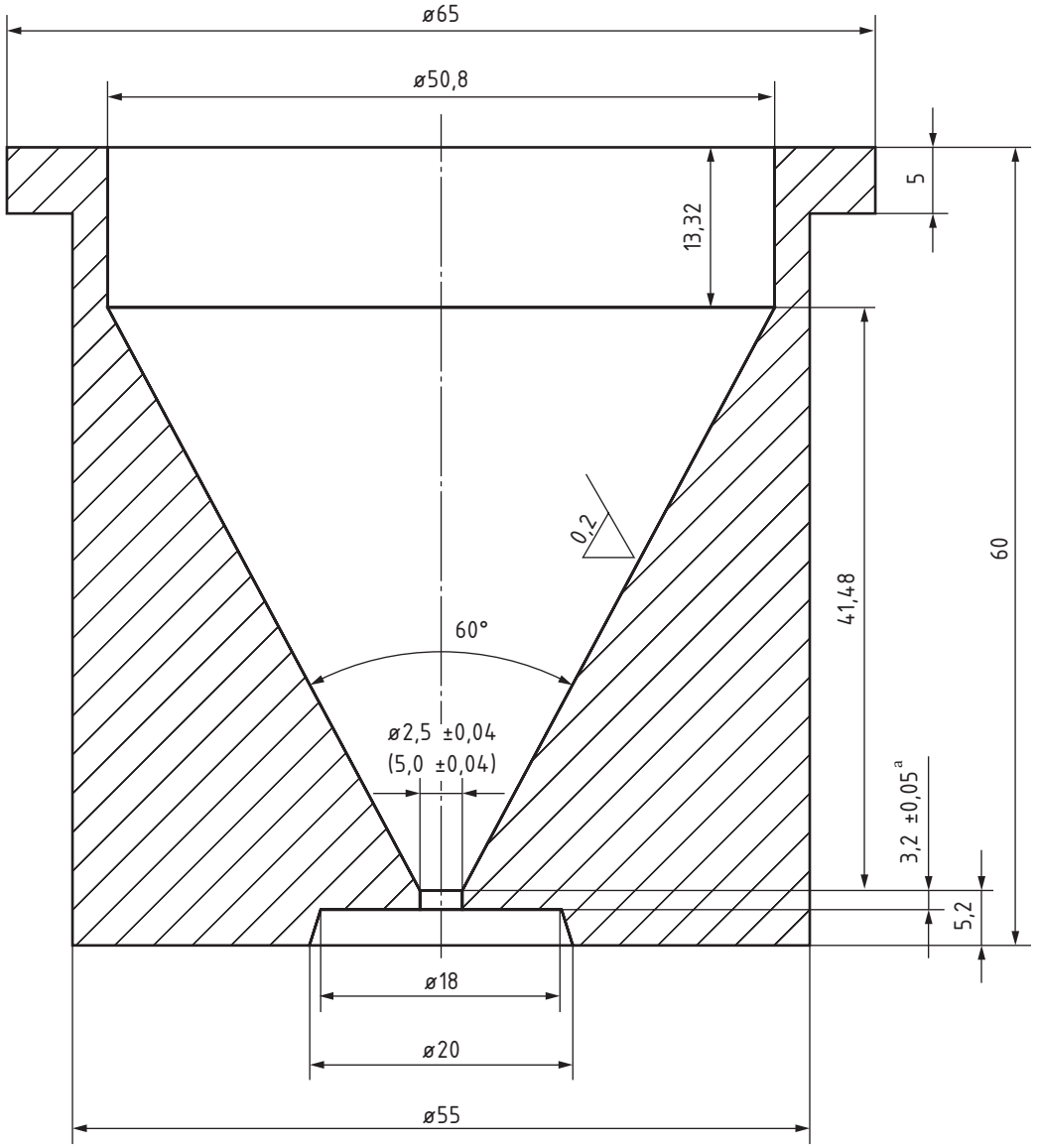
A glove composed of a cotton which minimizes static electricity.

NOTE The material of a suitable glove is dependent on safety instructions of powder manufacturer. If possible, use gloves of cotton, polyethylene, latex, etc.

4.8 Level meter

A level meter capable of checking the horizontality of the funnel.

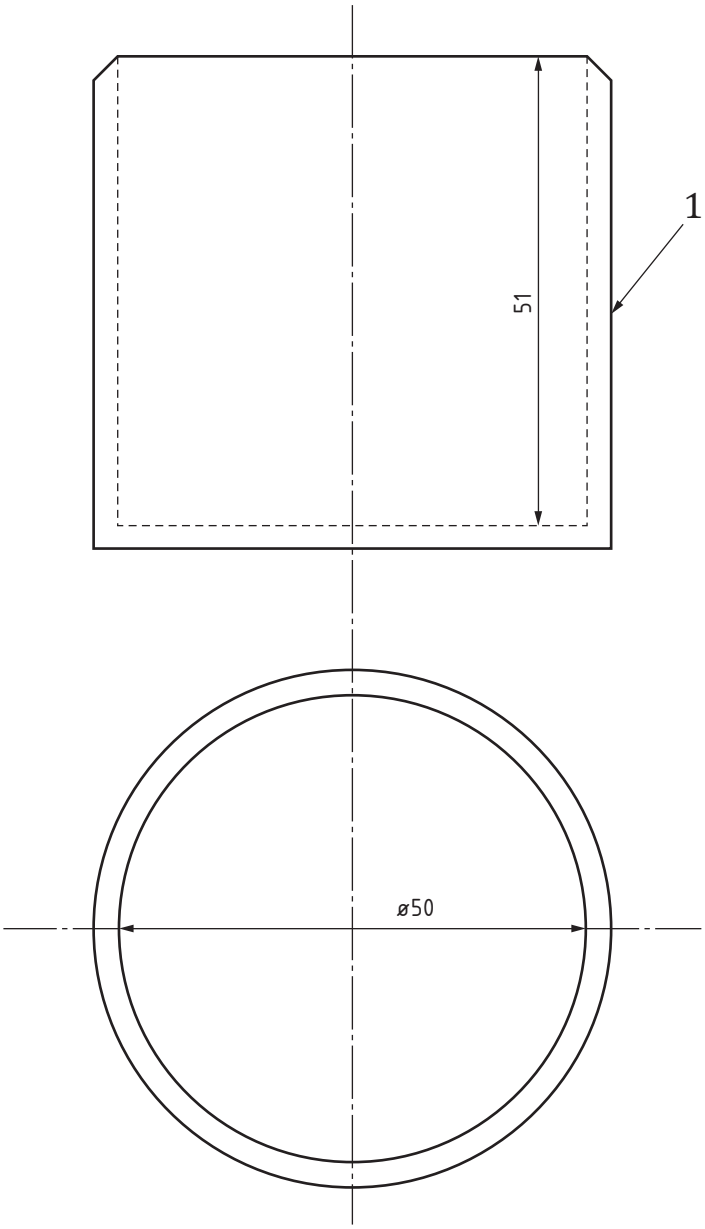
Dimensions in millimetres



[a] or 6,4 ± 0,05 for 5,0 diameter

Figure 1 — Example of funnel

Dimensions in millimetres

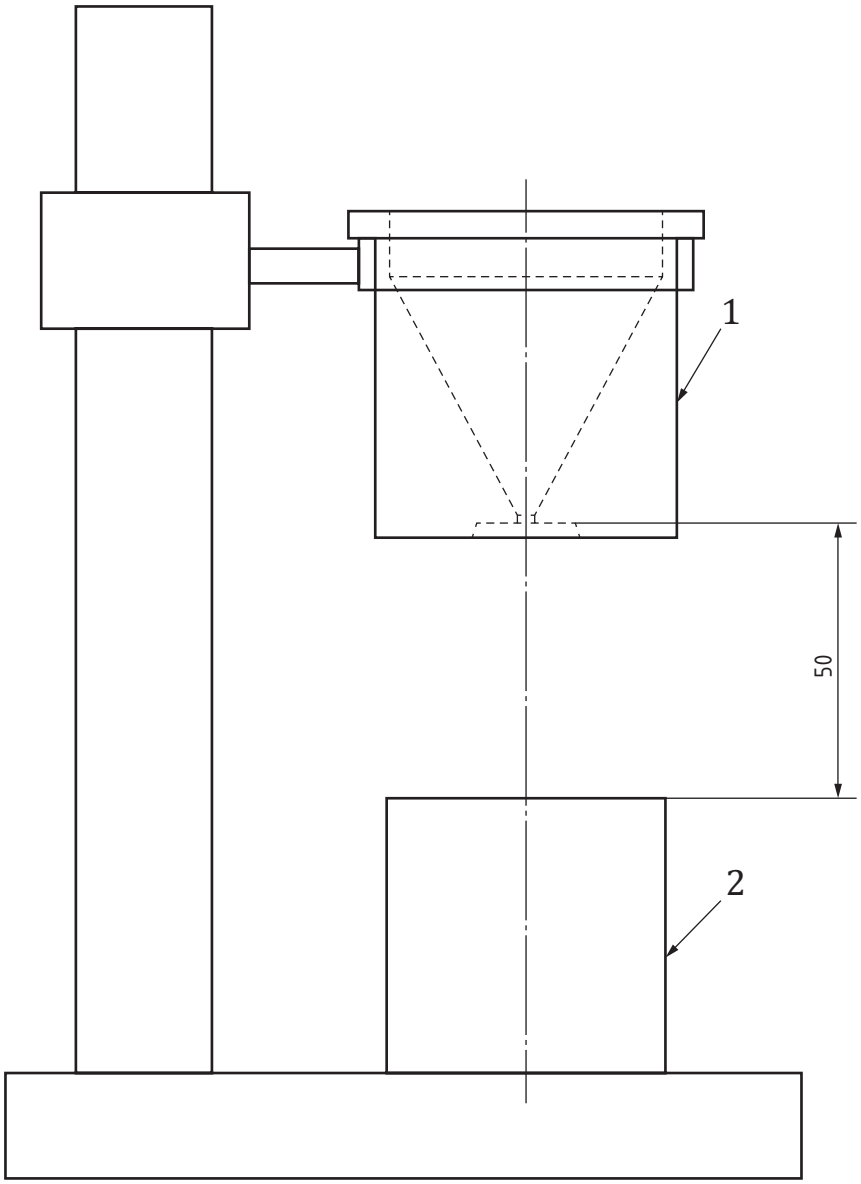


Key

1 container

Figure 2 — Example of container

Dimensions in millimetres



Key

1 funnel
2 container

Figure 3 — Example of apparatus for flowability

5 Sampling

5.1 The mass of the test samples shall be at least 200 g.

5.2 In general, the powder should be tested in the as-received condition. In certain instances, the powder may be dried. If the powder is required to be dried, it should be dried at (110 ± 5)°C for at least 1 h and cooled down to room temperature in a desiccator. If the powder contains volatile substances, it shall not be dried.

5.3 Should there be any treatment (e.g. drying) of the powder before measurement, it shall be recorded in the test report.

5.4 Immediately before the test, weigh out 50,0 g of test portion.

5.5 The determination shall be carried out on three test portions.

6 Test method

6.1 Weigh an empty and clean container (m_0).

6.2 Pass the ceramic powder through the sieve.

6.3 Weigh out a 50,0 g mass of the powder, as sampled, into another clean container.

6.4 Place the funnel on its stand and make sure that the upper rim is horizontal.

NOTE If the powder does not flow through the 2,5 mm diameter orifice, use the funnel having the 5,0 mm diameter orifice.

6.5 Place the empty container on the base directly under the funnel orifice.

6.6 Block the orifice at the bottom of the funnel with a finger wearing a glove.

6.7 Carefully pour the 50,0 g test portion of powder into the centre of the funnel without any tapping, vibration or movement of the funnel.

6.8 Simultaneously remove your finger from the discharge orifice and start the stopwatch.

If the powder fails to start flowing or flow continuously, this shall be recorded in the test report.

6.9 Stop the stopwatch at the instant when the last of the powder leaves the orifice.

6.10 Record the elapsed flow time to the nearest 0,1 s (t).

NOTE It is desirable that the elapsed times for the flow of 50,0 g powder should be measured using an apparatus which can sense the flow of powder and record the elapsed time automatically. Automatic time-recording makes the flowability data more accurate than manual time-recording. In addition, the deviation of flowability data recorded automatically is smaller than that recorded manually.

6.11 Weigh the container and its contents (m_1).

6.12 Repeat 6.1 to 6.11 with two additional portions and average the results.

7 Calculation

Calculate the flowability of the ceramic powder, F, expressed as grams per second, using the following equation and round to 0,01 g/s in accordance with ISO 80000-1.

$$F = \frac{m_1 - m_0}{t} \quad (1)$$

where

F is the flowability, in grams per second, of the ceramic powder;

m_0 is the mass, in grams, of the empty container;

m_1 is the mass, in grams, of the container and the ceramic powder;

t is the elapsed flow time, in seconds, of the ceramic powder.

8 Test report

The test report shall be in accordance with the reporting provisions of ISO/IEC 17025 and shall contain the following:

a) the name of the testing establishment;

b) date of the test, report identification and number, operator, signatory;

c) temperature and relative humidity in the laboratory;

d) a reference to this International Standard;

e) all details for identification of the test sample (material type, manufacturer, batch or code number);

f) all operations not specified by this International Standard, or regarded as optional (e.g. any pre-treatment of the powder such as drying);

g) the results obtained; flowability (g/s);

h) details of any occurrence which may have affected the result (e.g. blockage of orifice, etc.).

i) comments about the test or test results.

Bibliography

[1] ENV 14312, *Advanced technical ceramics — Ceramic powders — Determination of flowability behavior of ceramic granules*

[2] JIS R 1639-4, *Test methods of properties of fine ceramic granules — Part 4: Flowability*

[3] ISO 4490, *Metallic powders — Determination of flow rate by means of a calibrated funnel (Hall flowmeter)*

[4] ASTM B213, *Standard Test Method for Flow Rate of Metal Powders*

[5] JIS Z 2502, *Metallic powders — Determination of flowability by means of a calibrated funnel (Hall flowmeter)*

[6] KS L 1626, *Testing method for flowability of fine ceramic powders*

[7] ISO 690, *Information and documentation — Guidelines for bibliographic references and citations to information resources*

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