

---

---

**Fine ceramics (advanced ceramics,  
advanced technical ceramics) — Test  
method for spherical indentation of  
porous ceramics**

*Céramiques techniques — Méthode d'essai d'indentation des  
céramiques poreuses avec un indenteur sphérique*

STANDARDSISO.COM : Click to view the full PDF of ISO 17170:2015



STANDARDSISO.COM : Click to view the full PDF of ISO 17170:2015



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2015, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
Ch. de Blandonnet 8 • CP 401  
CH-1214 Vernier, Geneva, Switzerland  
Tel. +41 22 749 01 11  
Fax +41 22 749 09 47  
copyright@iso.org  
www.iso.org

# Contents

	Page
Foreword .....	iv
<b>1 Scope .....</b>	<b>1</b>
<b>2 Normative references .....</b>	<b>1</b>
<b>3 Terms and definitions .....</b>	<b>1</b>
<b>4 Test specimens .....</b>	<b>2</b>
4.1 Specimen size .....	2
4.2 Specimen preparation .....	2
4.3 Number of specimens .....	2
<b>5 Testing machine and equipment .....</b>	<b>2</b>
5.1 Testing machine .....	2
5.2 Spherical indenter .....	3
5.3 Pedestal .....	3
5.4 Micrometer calipers .....	3
5.5 Dial gauges .....	3
5.6 Humidity measuring device .....	3
<b>6 Testing method .....</b>	<b>3</b>
6.1 Measurement of specimen dimension .....	3
6.2 Specimen positioning and loading method .....	3
6.3 Crosshead speed .....	4
6.4 Measurement of load and load-point displacement .....	4
6.5 Reuse of pedestal .....	5
6.6 Measurement of temperature and humidity .....	5
6.7 Reuse of spherical indenter .....	5
6.8 Number of tests .....	5
<b>7 Treatment of test result .....</b>	<b>5</b>
7.1 Load vs. load-point displacement curve .....	5
7.2 Strength of spherical indentation .....	5
7.3 Calculation of mean value and standard variation .....	6
<b>8 Test report .....</b>	<b>6</b>
8.1 Items to be reported .....	6
8.2 Items preferred to be reported .....	6

## 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.

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](http://www.iso.org/directives)).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC 206, *Fine ceramics*.

# Fine ceramics (advanced ceramics, advanced technical ceramics) — Test method for spherical indentation of porous ceramics

## 1 Scope

This International Standard describes the test methods for determining spherical indentation strength of porous ceramics, such as those employed for filters and catalyst carriers, that are carried out in air at room temperature.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 463, *Geometrical Product Specifications (GPS) — Dimensional measuring equipment — Design and metrological characteristics of mechanical dial gauges*

ISO 683-1, *Heat-treatable steels, alloy steels and free-cutting steels — Part 1: Non-alloy steels for quenching and tempering*

ISO 683-3, *Heat-treatable steels, alloy steels and free-cutting steels — Part 3: Case-hardening steels*

ISO 1101, *Geometrical product specifications (GPS) — Geometrical tolerancing — Tolerances of form, orientation, location and run-out*

ISO 3290-1, *Rolling bearings — Balls — Part 1: Steel balls*

ISO 3611, *Geometrical product specifications (GPS) — Dimensional measuring equipment: Micrometers for external measurements — Design and metrological characteristics*

ISO 4287, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Terms, definitions and surface texture parameters*

ISO 7500-1, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Verification and calibration of the force-measuring system*

## 3 Terms and definitions

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

### 3.1

#### **porous ceramics**

ceramics with porosity of 30 % to 60 %, and pore diameter of 1  $\mu\text{m}$  to 100  $\mu\text{m}$ , for applications such as filters, catalyst carriers, humidity sensors, or molecular sieves, excluding structured honeycomb cellular channels

### 3.2

#### **spherical indenter**

sphere through which a compressive load is applied to the specimen

### 3.3

#### fracture by spherical indentation

fracture is the separation of a specimen into more than two pieces, or many small flakes or powder-like pieces, accompanied by a large drop or disappearance of force

### 3.4

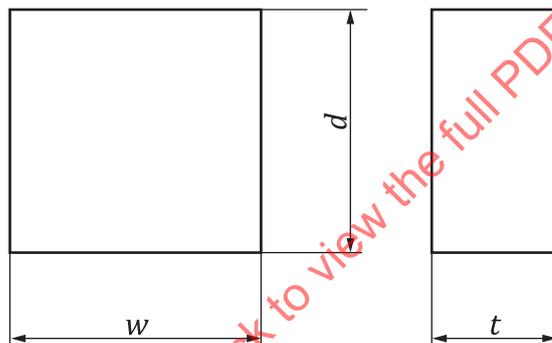
#### strength by spherical indentation

maximum load measured in the period from start of test to the fracture of the test specimen when the compressive load is applied to the specimen through the spherical indenter

## 4 Test specimens

### 4.1 Specimen size

The shape of a test specimen shall be a flat plate with a regular square cross section. Its standard dimensions shall be 20,0 mm  $\pm$  0,1 mm in horizontal length, 20,0 mm  $\pm$  0,1 mm in vertical length, and 10,0 mm  $\pm$  0,1 mm in thickness. The parallelism between the upper and lower surfaces of the specimen shall be at most 0,01 mm specified in ISO 1101. When the dimensions are different from the standard one, they shall be stated in a report.



#### Key

- $d$  vertical length ( $d = 20,0 \text{ mm} \pm 0,1 \text{ mm}$ )
- $w$  horizontal length ( $w = 20,0 \text{ mm} \pm 0,1 \text{ mm}$ )
- $t$  thickness ( $t = 10,0 \text{ mm} \pm 0,1 \text{ mm}$ )

Figure 1 — Specimen dimensions

### 4.2 Specimen preparation

The specimen surface shall be finished by grinding with a wheel whose grain number is at least 800. Contamination by fixatives (e.g. wax) or grinding fluids employed during grinding processes, if any, should be removed by organic dissolution, or by heating at a sufficiently high temperature.

### 4.3 Number of specimens

The number of specimens shall be at least 10.

## 5 Testing machine and equipment

### 5.1 Testing machine

A testing machine shall be so constructed that compressive stress can be applied to a test specimen at a constant crosshead speed. The testing machine shall be equipped with an apparatus measuring

or indicating the load with an accuracy of at most  $\pm 1$  % of the maximum load in accordance with ISO 7500-1 or have better precision.

## 5.2 Spherical indenter

A steel sphere with 3/4 inch (19,05 mm) or 19 mm diameter specified in ISO 3290-1 shall be used as an indenter.

## 5.3 Pedestal

A pedestal placed below the specimen shall be made of carbon steel for mechanical use with a carbon content of 0,4 % to 0,6 % defined by in ISO 683-1 and ISO 683-3 or materials with the hardness over 150 Hv. The thickness of the pedestal shall be at least 10 mm, and the surface area of the pedestal contacting with the specimen is at least four times of the specimen cross-section area. The surface of the pedestal contacting the specimen shall be at most  $R_a = 0,40 \mu\text{m}$  determined in accordance with ISO 4287, and the parallelism shall be at most 0,01 mm specified in ISO 1101.

## 5.4 Micrometer calipers

Micrometer calipers shall be those for external measurement in accordance with ISO 3611 or have better precision.

## 5.5 Dial gauges

Dial gauges shall be those with a scale of 0,01 mm in accordance with ISO 463 or have a better precision.

## 5.6 Humidity measuring device

Humidity measuring device shall be equipped with a performance measuring or indicating the humidity with an accuracy of at most  $\pm 5$  % RH.

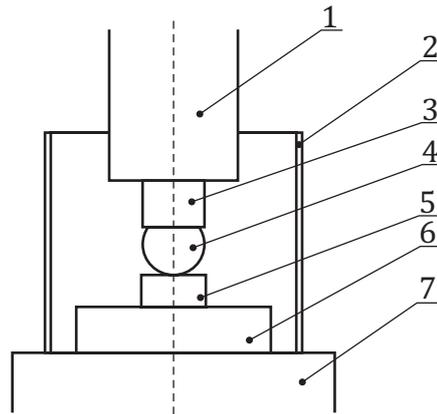
# 6 Testing method

## 6.1 Measurement of specimen dimension

The horizontal and vertical lengths and thickness of the specimen shall be measured to a precision of 0,01 mm by using micrometer calipers for external measurement or a measuring instrument at least equal in precision thereto.

## 6.2 Specimen positioning and loading method

The specimen is positioned at the centre of the pedestal. The central axis of the pedestal, specimen and spherical indenter are aligned along the load line. The specimen shall be loaded by forcing the spherical indenter into the test specimen. [Figure 2](#) illustrates a testing setup.



**Key**

- 1 loading jig
- 2 scattering prevention cover
- 3 spherical folder
- 4 spherical indenter
- 5 test specimen
- 6 pedestal
- 7 base of testing machine

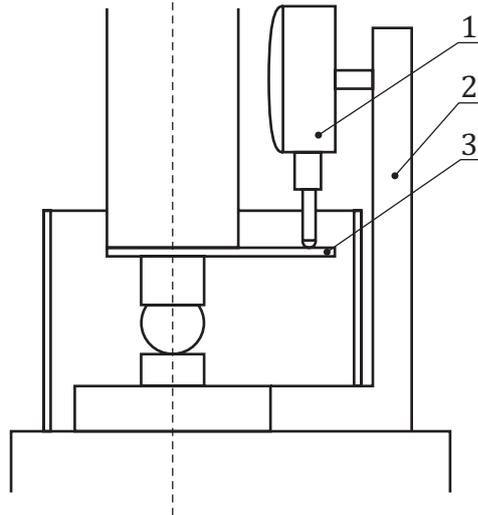
**Figure 2 — Testing setup for small spherical indentation**

**6.3 Crosshead speed**

The crosshead speed shall be 0,5 mm/min.

**6.4 Measurement of load and load-point displacement**

Load and load-point displacement shall be measured from the start of the test to the specimen fracture. The load point displacement shall be measured with a displacement meter such as an electronic dial gauge or transducer, as shown in [Figure 3](#), or from the crosshead displacement of testing machine.

**Key**

- 1 dial gauge
- 2 support of dial gauge
- 3 contact plate for load point displacement

**Figure 3 — Measurement of load-point displacement**

**6.5 Reuse of pedestal**

When the pedestal is reused, dimples or flaws shall be completely removed.

**6.6 Measurement of temperature and humidity**

When indentation tests are carried out, the temperature and humidity of the test environment shall be measured.

**6.7 Reuse of spherical indenter**

If a spherical indenter is to be reused, inspect it for damage. If dimples or flaws have been generated by prior use, an unused region of the sphere shall be used as the contact area with the test specimen.

**6.8 Number of tests**

The minimum number of successful tests shall be 10. Test specimens shall be used only for a single test.

**7 Treatment of test result****7.1 Load vs. load-point displacement curve**

A load vs. load-point displacement curve shall be drawn from the start of the test to the fracture of the test specimen.

**7.2 Strength of spherical indentation**

The maximum load which is determined from load vs. load-point displacement curve shall be the strength of spherical indentation. Also, the load-point displacement at the maximum load shall be recorded.