
**Fine ceramics (advanced ceramics,
advanced technical ceramics) — Test
method for hardness of monolithic
ceramics at room temperature**

*Céramiques techniques — Méthode d'essai de dureté des céramiques
monolithiques à température ambiante*

Sample Document

get full document from standards.iteh.ai



Reference number
ISO 14705:2016(E)

© ISO 2016

Sample Document

get full document from standards.iteh.ai



COPYRIGHT PROTECTED DOCUMENT

© ISO 2016, 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
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Vickers hardness	2
4.1 Principle.....	2
4.2 Symbols, abbreviated terms and designations.....	2
4.3 Significance and use	4
4.4 Apparatus.....	5
4.5 Test pieces.....	5
4.6 Procedure.....	5
4.7 Accuracy and uncertainties.....	7
4.8 Test report.....	8
5 Knoop hardness	11
5.1 Principle.....	11
5.2 Symbols and designations.....	11
5.3 Significance and use	13
5.4 Apparatus.....	14
5.5 Test pieces.....	14
5.6 Procedure.....	14
5.7 Accuracy and uncertainty.....	15
5.8 Test report.....	16
Bibliography	20

get full document from standards.iteh.ai

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).

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).

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 World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

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

This third edition cancels and replaces the second edition (ISO 14705:2008), which has been technically revised.

Fine ceramics (advanced ceramics, advanced technical ceramics) — Test method for hardness of monolithic ceramics at room temperature

1 Scope

This document specifies a test method for determining the Vickers and Knoop hardness of monolithic fine ceramics at room temperature.

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 4545-1, *Metallic materials — Knoop hardness test — Part 1: Test method*

ISO 4545-2, *Metallic materials — Knoop hardness test — Part 2: Verification and calibration of testing machines*

ISO 4545-4, *Metallic materials — Knoop hardness test — Part 4: Table of hardness values*

ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method*

ISO 6507-2, *Metallic materials — Vickers hardness test — Part 2: Verification and calibration of testing machines*

3 Terms and definitions

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

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

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

Vickers hardness

value obtained by dividing the applied force by the surface area of the indentation computed from the mean of the measured diagonals of the indentations, assuming that the indentation is an imprint of the undeformed indenter

Note 1 to entry: Vickers hardness may be expressed in two different units:

- a) with unit GPa, obtained by dividing the applied force in N by the surface area of the indentation in mm²;
- b) Vickers hardness number, obtained by dividing the applied force in kgf by the surface area of the indentation in mm².

3.2

Vickers indenter

indenter in the shape of a right-angle pyramid with a square base and an angle between opposite faces of 136°

Note 1 to entry: See [Table 1](#) and [Figure 1](#).

3.3

Knoop hardness

value obtained by dividing the applied force by the projected area of the indentation computed from the measurement of the long diagonal of the indentation, assuming that the indentation is an imprint of the undeformed indenter

Note 1 to entry: The Knoop hardness may be expressed in two different units:

- a) with units of GPa, obtained by dividing the applied force in N by the projected area of the indentation in mm^2 ;
- b) Knoop hardness number, obtained by dividing the applied force in kgf by the projected area of the indentation in mm^2 , without units specified.

3.4

Knoop indenter

indenter in the shape of a rhombic-based pyramid with the two angles between the opposite edges at $172,5^\circ$ and 130°

Note 1 to entry: See [Table 3](#) and [Figure 6](#).

4 Vickers hardness

4.1 Principle

Forcing a diamond indenter in the form of a right-angle pyramid with a square base, and with a specified angle between opposite faces at the vertex into the surface of a test piece and measuring the length of the diagonals of the indentation left in the surface after removal of the test force, F . See [Figure 1](#) and [Figure 2](#).

4.2 Symbols, abbreviated terms and designations

4.2.1 See [Table 1](#), [Figure 1](#) and [Figure 2](#).

4.2.2 The Vickers hardness is denoted by the symbol HV, preceded by the hardness value and followed by a number representing the test force (see [Table 2](#)).

Examples:

- a) Use of SI unit (GPa):

15,0 GPa HV 9,807 N represents a Vickers hardness of 15,0 GPa, determined with a test force of 9,807 N (1 kgf)

- b) Use of the Vickers hardness number (no units specified):

1 500 HV 1 represents a Vickers hardness number of 1 500, determined with a test force of 9,807 N (1 kgf).

Table 1 — Symbols, abbreviated terms and designations for Vickers hardness testing

Symbol or abbreviated term	Designation
α	Angle between the opposite faces at the vertex of the pyramidal indenter ($136^\circ \pm 0,5^\circ$)
F	Test force, in newtons
d	Arithmetic mean, in millimetres, of the two diagonals, d_1 and d_2
HV	Vickers hardness $= \text{Constant} \times \frac{\text{Test force}}{\text{Surface area of indentation}}$ a) Units of GPa $= 0,001 \frac{2F \sin \frac{136^\circ}{2}}{d^2} = 0,001 \ 854 \frac{F}{d^2}$ b) Hardness number (no units specified) $= 0,102 \frac{2F \sin \frac{136^\circ}{2}}{d^2} = 0,189 \ 1 \frac{F}{d^2}$
c	Arithmetic mean of the half of the two median crack lengths, $2c_1$ and $2c_2$
SD	Standard deviation $= \sqrt{\frac{\sum (\overline{\text{HV}} - \text{HV}_n)^2}{n-1}}$ where $\overline{\text{HV}}$ is the arithmetic mean of the Vickers hardness $= \frac{\sum \text{HV}_n}{n}$; HV_n is the HV obtained from nth indentation; n is the number of indentations.
NOTE Constant $= \frac{1}{g} = \frac{1}{9,807} = 0,102$, where g is the acceleration due to gravity.	

Table 2 — Hardness symbols and the nominal values of test forces, F , for Vickers hardness testing

Hardness symbol	Test force, F (nominal value)
HV 0,5	4,903 N
HV 1	9,807 N
HV 2	19,61 N
HV 3	29,42 N
HV 5	49,03 N
HV 10	98,07 N
HV 20	196,1 N