BS EN ISO 14705:2021

BSI Standards Publication

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

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National foreword

This British Standard is the UK implementation of EN ISO 14705:2021. It is identical to ISO 14705:2016. It supersedes BS ISO 14705:2016, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee RPI/13, Advanced technical ceramics.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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28 February 2021	This corrigendum renumbers BS ISO 14705:2016 as BS EN ISO 14705:2021

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English Version

Fine ceramics (advanced ceramics, advanced technical ceramics) - Test method for hardness of monolithic ceramics at room temperature (ISO 14705:2016)

Céramiques techniques - Méthode d'essai de dureté des céramiques monolithiques à température ambiante (ISO 14705:2016)

Hochleistungskeramik - Härteprüfung von monolithischer Keramik bei Raumtemperatur (ISO 14705:2016)

This European Standard was approved by CEN on 20 December 2020.

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European foreword

The text of ISO 14705:2016 has been prepared by Technical Committee ISO/TC 206 "Fine ceramics" of the International Organization for Standardization (ISO) and has been taken over as EN ISO 14705:2021 by Technical Committee CEN/TC 184 "Advanced technical ceramics" the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 2021, and conflicting national standards shall be withdrawn at the latest by July 2021.

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Endorsement notice

The text of ISO 14705:2016 has been approved by CEN as EN ISO 14705:2021 without any modification.

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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.

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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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.

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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 mm^2;

b) Vickers hardness number, obtained by dividing the applied force in kgf by the surface area of the indentation in mm^2.

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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° 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).

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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° ± 0,5°)
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 $= 0{,}001 \frac{2F \sin \frac{136°}{2}}{d^2} = 0{,}001\ 854 \frac{F}{d^2}$ b) Hardness number (no units specified) $= 0{,}102 \frac{2F \sin \frac{136°}{2}}{d^2} = 0{,}189\,1 \frac{F}{d^2}$
c	Arithmetic mean of the half of the two median crack lengths, $2c_1$ and $2c_2$
SD	Standard deviation $= \sqrt{\frac{\sum \left(\overline{\text{HV}} - \text{HV}_n\right)^2}{n-1}}$ 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

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