



# Standard Test Method for Knoop Indentation Hardness of Advanced Ceramics<sup>1</sup>

This standard is issued under the fixed designation C1326; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This test method covers the determination of the Knoop indentation hardness of advanced ceramics. In this test, a pointed, rhombic base, pyramidal diamond indenter of prescribed shape is pressed into the surface of a ceramic with a predetermined force to produce a relatively small, permanent indentation. The surface projection of the long diagonal of the permanent indentation is measured using a light microscope. The length of the long diagonal and the applied force are used to calculate the Knoop hardness which represents the material's resistance to penetration by the Knoop indenter.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 *Units*—When Knoop and Vickers hardness tests were developed, the force levels were specified in units of grams-force (gf) and kilograms-force (kgf). This standard specifies the units of force and length in the International System of Units (SI); that is, force in newtons (N) and length in mm or  $\mu\text{m}$ . However, because of the historical precedent and continued common usage, force values in gf and kgf units are occasionally provided for information. This test method specifies that Knoop hardness be reported either in units of GPa or as a dimensionless Knoop hardness number.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

**C730** Test Method for Knoop Indentation Hardness of Glass

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee C28 on Advanced Ceramics and is the direct responsibility of Subcommittee C28.01 on Mechanical Properties and Performance.

Current edition approved Aug. 1, 2013. Published October 2013. Originally approved in 1996. Last previous edition approved in 2008 as C1326 – 08<sup>ε1</sup>. DOI: 10.1520/C1326-13.

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

**C849** Test Method for Knoop Indentation Hardness of Ceramic Whitewares

**E4** Practices for Force Verification of Testing Machines

**E177** Practice for Use of the Terms Precision and Bias in ASTM Test Methods

**E384** Test Method for Knoop and Vickers Hardness of Materials

**E691** Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

**IEEE/ASTM SI 10** Standard for Use of the International System of Units (SI) (The Modern Metric System)

### 2.2 European Standard:

**CEN ENV 843-4** Advanced Technical Ceramics, Monolithic Ceramics, Mechanical Properties at Room Temperature, Part 4: Vickers, Knoop, and Rockwell Superficial Hardness Tests<sup>3</sup>

### 2.3 ISO Standard:

**ISO 9385** Glass and Glass Ceramics—Knoop Hardness Test<sup>4</sup>

## 3. Terminology

### 3.1 Definitions:

3.1.1 *Knoop hardness number (HK), n*—an expression of hardness obtained by dividing the force applied to the Knoop indenter by the projected area of the permanent impression made by the indenter.

3.1.2 *Knoop indenter, n*—a rhombic-based pyramidal-shaped diamond indenter with edge angles of 172° 30' and 130° 00'.

## 4. Summary of Test Method

4.1 This test method describes an indentation hardness test using a calibrated machine to force a pointed, rhombic base, pyramidal diamond indenter having specified face angles, under a predetermined force, into the surface of the material under test and measures the surface projection of the long diagonal of the resulting impression after removal of the load.

NOTE 1—A general description of the Knoop indentation hardness test

<sup>3</sup> Available from European Committee for Standardization (CEN), 36 rue de Stassart, B-1050, Brussels, Belgium, <http://www.cenorm.be>.

<sup>4</sup> Available from International Organization for Standardization (ISO), 1, ch. de la Voie-Creuse, Case postale 56, CH-1211, Geneva 20, Switzerland, <http://www.iso.ch>.