Designation: C 1326 – 03

Standard Test Method for Knoop Indentation Hardness of Advanced Ceramics[1]

This standard is issued under the fixed designation C 1326; 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 (ϵ) 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.

1.2 *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:* [2]

C 730 Test Method for Knoop Indentation Hardness of Glass

C 849 Test Method for Knoop Indentation Hardness of Ceramic Whitewares

E 4 Practices for Force Verification of Testing Machines

E 177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E 380 Practice for Use of the International System of Units (SI) (the Modernized Metric System)

E 384 Test Method for Microhardness of Materials

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

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[3]

2.3 *ISO Standard:*

ISO 9385 Glass and Glass Ceramics—Knoop Hardness Test[4]

3. Terminology

3.1 Definition:

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 load, 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 is given in Test Method E 384. The present test method differs from this description only in areas required by the special nature of advanced ceramics.

NOTE 2—This test method is similar to Test Methods C 730 and C 849, but differs primarily in the choice of load and the rate of loading. In addition, the length correction factor for the resolution limits of optical microscopes is not utilized.

5. Significance and Use

5.1 For advanced ceramics, Knoop indenters are used to create indentations. The surface projection of the long diagonal is measured with optical microscopes.

5.2 The Knoop indentation hardness is one of many properties that is used to characterize advanced ceramics. Attempts have been made to relate Knoop indentation hardness to other hardness scales, but no generally accepted methods are available. Such conversions are limited in scope and should be used with caution, except for special cases where a reliable basis for the conversion has been obtained by comparison tests.

5.3 For advanced ceramics, the Knoop indentation is often preferred to the Vickers indentation since the Knoop long diagonal length is 2.8 times longer than the Vickers diagonal for the same load, and cracking is much less of a problem **(1)**.[5] On the other hand, the long slender tip of the Knoop indentation is more difficult to precisely discern, especially in materials with low contrast. The indentation loads chosen in this test

[1] This test method is under the jurisdiction of ASTM Committee C28 on Advanced Ceramics and is the direct responsibility of Subcommittee C28.01 on Properties and Performance.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from European Committee for Standardization, Brussels, Belgium.

[4] Available from International Standards Organization, Geneva, Switzerland.

[5] The boldface numbers in parentheses refer to the list of references at the end of this test method.

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