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AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Test Method for Vickers Indentation Hardness of Advanced Ceramics¹

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1. Scope

1.1 This test method covers the determination of the Vickers 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:

E 4 Practices for Force Verification of Testing Machines²

E 177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods³

E 380 Practice for Use of the International System of Units (SI) (the Modernized Metric System)³

E 384 Test Method for Microhardness of Materials²

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method³

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 Hardness⁴

2.3 Japanese Standard:

JIS R 1610 Testing Method for Vickers Hardness of High Performance Ceramics⁵

2.4 ISO Standard:

ISO 6507/2 Metallic Materials—Hardness test—Vickers test—Part 2: HV0.2 to less than HV5⁶

3. Terminology

3.1 Definition:

3.1.1 *Vickers hardness number (HV), n*—an expression of hardness obtained by dividing the force applied to a Vickers

indenter by the surface area of the permanent impression made by the indenter.

3.1.2 *Vickers indenter, n*—a square-based pyramidal-shaped diamond indenter with face angles of 136° 00'.

4. Summary of Test Method

4.1 This test method describes an indentation hardness test using a calibrated machine to force a pointed, square base, pyramidal diamond indenter having specified face angles, under a predetermined load, into the surface of the material under test and to measure the surface-projected diagonals of the resulting impression after removal of the load.

NOTE 1—A general description of the Vickers indentation hardness test is given in Test Method E 384. The present method is very similar, has most of the same requirements, and differs only in areas required by the special nature of advanced ceramics. This test method also has many elements in common with standards ENV 843-4 and JIS R 1610, which are also for advanced ceramics.

5. Significance and Use

5.1 For advanced ceramics, Vickers indenters are used to create indentations whose surface-projected diagonals are measured with optical microscopes. The Vickers indenter creates a square impression from which two surface-projected diagonal lengths are measured. Vickers hardness is calculated from the ratio of the applied load to the area of contact of the four faces of the undeformed indenter. (In contrast, Knoop indenters are also used to measure hardness, but Knoop hardness is calculated from the ratio of the applied load to the projected area on the specimen surface.)

5.2 Vickers indentation hardness is one of many properties that is used to characterize advanced ceramics. Attempts have been made to relate Vickers 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 Vickers indentation diagonal lengths are approximately 2.8 times shorter than the long diagonal of Knoop indentations, and the indentation depth is approximately 1.5 times deeper than Knoop indentations made at the same load.

5.4 Vickers indentations are influenced less by specimen surface flatness, parallelism, and surface finish than Knoop indentations, but these parameters must be considered nonetheless.

¹ This test method is under the jurisdiction of ASTM Committee C-28 on Advanced Ceramics and is the direct responsibility of Subcommittee C28.01 on Properties and Performance.

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² Annual Book of ASTM Standards, Vol 03.01.

³ Annual Book of ASTM Standards, Vol 14.02.

⁴ Available from European Committee for Standardization, Brussels, Belgium.

⁵ Available from Japanese Standards Association, Tokyo, Japan.

⁶ Available from International Standards Organization, Geneva, Switzerland.