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AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Test Method for Transverse Rupture Strength of Cemented Carbides[1]

This standard is issued under the fixed designation B 406; 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[2] covers the determination of the transverse rupture strength of cemented carbides.

1.2 The values stated in inch-pound units are to be regarded as the standard. The SI values in parentheses are provided for information only.

1.3 *This standard does not purport to address 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 *ISO Standard:*

ISO-3327 Hardmetals—Determination of Transverse Rupture Strength[3]

3. Significance and Use

3.1 This test method is used as a means of determining the quality of cemented carbide grade powders by measuring their sintered strength. It is performed on test specimens prepared to specified shape, dimensions, and surface finish; test specimens may be prepared from finished parts if size permits. There is no known standard material for this test method. The transverse rupture strength of cement carbides is not a design value.

3.1.1 Most commercial cemented carbides have mechanical behavior that is best classified as brittle (negligible ductility). Fracture strengths are dependent on internal or surface flaws. Examples of incoherent internal flaws are macropores, Type B porosity,[4] and inclusions of foreign particles. Such flaws are randomly distributed spatially and in size within the sintered material. This imparts a statistical nature to any transverse rupture strength measurement.

3.1.2 The stress distribution in a beam in three-point loading is non-uniform. It increases linearly along the span to a maximum at the center, and varies linearly through any section from compression on the top to tension on the bottom. The maximum tensile stress therefore occurs at center span in the bottom most fibers of the sample, and is defined as the transverse rupture strength at failure. Failure is initiated at a random flaw site, which is most probably not coincident with the maximum stress. This imparts an additional statistical nature to transverse rupture strength measurements.

4. Apparatus

4.1 Either a specially adapted machine for applying the load or a special fixture suitable for use with a conventional load-applying machine may be used. In either case, the apparatus shall have the following parts:

4.1.1 Two ground-cemented-carbide cylinders 0.250 ± 0.001 in. (6.35 ± 0.02 mm) in diameter, at least 0.500 in. (13 mm) in length with the long axes parallel, and center to center spacing of 0.563± 0.005 in. (14.3 ± 0.1 mm).

4.1.2 A movable member (free to move substantially only in a line perpendicular to the plane established by the axes of the two cylinders) containing a 0.4 ± 0.05-in. (10 ± 1.3-mm) cemented-tungsten-carbide ball or a ground-cemented-carbide cylinder of the same dimensions as, and with axis parallel to, those of the two previously mentioned cylinders (see 4.1.1). This ball or cylinder shall be so positioned that movements of the member will cause the ball or cylinder to contact a specimen placed on the two lower cylinders at the midpoint of the span between them.

4.1.3 The apparatus shall be so constructed that the application of a sufficient load to the movable member to effect breaking of a specimen will not cause appreciable deflection of the line of movement of the movable member and the plane established by the two fixed cylinders. The apparatus shall be capable of applying sufficient load to break the specimen. The apparatus shall be capable of registering the load required (within ±1 % of the load) to break the specimen. The cemented-tungsten-carbide ball and cylinders shall not show permanent deformation after use.

5. Specimen Size

5.1 The cemented carbide specimens shall be ground to the following dimensions: 0.200 ± 0.010 in. (5.00 ± 0.25 mm) thick by 0.250 ± 0.010 in. (6.25 ± 0.25 mm) wide by 0.750 in. (19.0 mm) minimum long.

6. Specimen Preparation

6.1 Specimens shall be ground to a surface finish of 15 µin.

[1] This test method is under the jurisdiction of ASTM Committee B-9 on Metal Powders and Metal Powder Products and is the direct responsibility of Subcommittee B09.06 on Cemented Carbides.

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[2] This test method is comparable to ISO-3327.

[3] Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

[4] See ASTM Standard B 276 Test Method for Apparent Porosity in Cemented Carbides, published in Vol 02.05 of the *Annual Book of ASTM Standards*.