



SLOVENSKI STANDARD

SIST EN ISO 15732:2005

01-november-2005

Fine ceramics (advanced ceramics, advanced technical ceramics) - Test method for fracture toughness of monolithic ceramics at room temperature by single edge precracked beam (SEPB) method (ISO 15732:2003)

Fine ceramics (advanced ceramics, advanced technical ceramics) - Test method for fracture toughness of monolithic ceramics at room temperature by single edge precracked beam (SEPB) method (ISO 15732:2003)

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Hochleistungskeramik - Prüfverfahren zur Bestimmung der Bruchzähigkeit monolithischer Keramik bei Raumtemperatur an einseitig gekerbten Biegeproben (SEPB-Verfahren) (ISO 15732:2003)

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Céramiques techniques - Méthode d'essai de ténacité a la rupture des céramiques monolithiques a température ambiante sur éprouvette préfissurée sur une seule face (méthode SEPB) (ISO 15732:2003)

Ta slovenski standard je istoveten z: EN ISO 15732:2005

ICS:

81.060.30 Sodobna keramika Advanced ceramics

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN ISO 15732

June 2005

ICS 81.060.30

English version

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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EN ISO 15732:2005 (E)**Foreword**

The text of ISO 15732:2003 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 15732:2005 by Technical Committee CEN/TC 184 "Advanced technical ceramics", the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by December 2005, and conflicting national standards shall be withdrawn at the latest by December 2005.

This document is part of a series:

CEN/TS 14425-1 *Advanced technical ceramics — Test methods for determination of fracture toughness of monolithic ceramics — Part 1: Guide to test method selection*

CEN/TS 14425-3 *Advanced technical ceramics — Test methods for determination of fracture toughness of monolithic ceramics — Part 3: Chevron notched beam (CNB) method*

CEN/TS 14425-5 *Advanced technical ceramics — Test methods for determination of fracture toughness of monolithic ceramics — Part 5: Single edge V-notch beam (SEVNB) method*

EN ISO 15732 *Fine ceramics (advanced ceramics, advanced technical ceramics) — Test method for fracture toughness of monolithic ceramics at room temperature by single edge precracked beam (SEPB) method*

EN ISO 18756 *Fine ceramics (advanced ceramics, advanced technical ceramics) — Determination of fracture toughness of monolithic ceramics at room temperature by the surface crack in flexure (SCF) method*

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Endorsement notice

The text of ISO 15732:2003 has been approved by CEN as EN ISO 15732:2005 without any modifications.

INTERNATIONAL
STANDARD

ISO
15732

First edition
2003-09-01

**Fine ceramics (advanced ceramics,
advanced technical ceramics) — Test
method for fracture toughness of
monolithic ceramics at room temperature
by single edge precracked beam (SEPB)
method**

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*Céramiques techniques — Méthode d'essai de ténacité à la rupture des
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Reference number
ISO 15732:2003(E)

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Published in Switzerland

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ISO 15732:2003(E)**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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 15732 was prepared by Technical Committee ISO/TC 206, *Fine ceramics*.

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Fine ceramics (advanced ceramics, advanced technical ceramics) — Test method for fracture toughness of monolithic ceramics at room temperature by single edge precracked beam (SEPB) method

1 Scope

This International Standard describes a test method for the determination of fracture toughness of monolithic ceramic materials at room temperature by the Single Edge Precracked Beam (SEPB) method.

This International Standard is intended for use with monolithic ceramics and whisker- or particulate-reinforced ceramics which are regarded as macroscopically homogeneous. It does not include continuous-fiber-reinforced ceramic composites.

This International Standard is for material development, material comparison, quality assurance, characterization, reliability and design data generation.

Fracture toughness values determined with other test methods cannot be interchanged with K_{Ipb} as defined in this International Standard, and may not be interchangeable with each other.

Values expressed in this International Standard are in accordance with the International System of Units (SI).

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2 Normative references

The following referenced documents are indispensable for the application 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 1101:1983, *Technical drawings — Geometrical tolerancing — Tolerancing of form, orientation, location and run-out — Generalities, definitions, symbols, indications on drawings*

ISO 3312:1987, *Sintered metal materials and hardmetals — Determination of Young modulus*

ISO 4287:1997, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Terms, definitions and surface texture parameters*

ISO 6507-1:1997, *Metallic materials — Vickers hardness test — Part 1: Test method*

ISO 15732:2003(E)

3 Terms and definitions

For the purpose of this document, the following terms and definitions apply.

3.1 stress intensity factor
 K_I
 magnitude of the elastic stress field singularity at the tip of a crack subjected to opening mode displacement

NOTE It is a function of applied force and test specimen size, geometry and crack length, and has the dimensions of force times length^{-3/2}.

3.2 fracture toughness
 generic term for the magnitude of resistance to crack extension

3.3 fracture toughness value
 K_{Ipb}
 fracture toughness value measured by the SEPB method

NOTE This represents the measured stress intensity factor corresponding to the extension resistance of a straight-through pop-in crack formed via bridge loading of a Vickers indent or a saw notch. The measurement is performed in accordance with the operational procedure described in Clauses 5 and 10 and satisfies all the validity requirements.

3.4 precrack
 crack induced artificially into a specimen, primarily so as to measure the fracture toughness

3.5 precrack front line
 line to indicate the position of the tip of the precrack

3.6 pop-in
 phenomenon where a crack arrests after sudden and unstable growth giving rise to an acoustic signature

3.7 three-point bending
 loading configuration where a beam specimen is loaded at a location midway between two support pins

3.8 four-point bending
 loading configuration where a beam specimen is symmetrically loaded at two locations that are situated one quarter of the overall span away from the outer two support pins

3.9 compliance
 reciprocal of the gradient of the load versus deflection curve

NOTE Accordingly, as the crack extends, the increase of deflection results in an increase of compliance.

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4 Symbols and designations

The symbols used throughout this International Standard and their designations are given in Table 1.

Table 1 — Symbols and designations

Symbol	Unit	Designation	References
b	mm	Width of central groove in anvil	A.2.3, Fig. A.1
d	mm	Thickness of specimen	7.1, Fig. 3
d_1	mm	Distance between supporting roller pins in bend test fixture (lower span)	6.4, Fig. 2
d_2	mm	Distance between loading roller pins in four-point bend test fixture (upper span)	6.4, Fig. 2
K_{Ipb}	MPa·m ^{1/2}	Critical stress intensity factor measured by the SEPB method	Clause 10, Eqs. 7 and 10
l	mm	Length of precrack	8.7.3, Fig. 6, Eq. 2
Δl	mm	Stable crack growth length	8.7.4, Fig. 6, Eq. 3
L	mm	Length of specimen	7.1, Fig. 3
L_a	mm	Length of bottom surface of specimen positioning groove of anvil (including the width, b , of central groove)	A.2.3, Fig. A.1
L_p	mm	Length of lower surface of loading plate	A.2.3, Fig. A.1
P_f	N	Maximum load during fracture of specimen	8.5.3, Fig. 5
w	mm	Width (depth) of specimen	7.1, Fig. 3
$\lambda \Delta l / \lambda l$	1	Compliance change	8.6, Eq. 1

5 Principle

This method is to obtain the fracture toughness value, K_{Ipb} , from the precrack length, specimen dimensions and distance between the bending supports by measuring the fracture load of specimen according to the three or four-point bending fracture test of a single-edge-precracked beam specimen. A straight-through pop-in precrack is induced in the specimen via bridge loading of a Vickers indent or a saw notch. Generally, this test is carried out under conditions of ambient temperature and environment.