SLOVENSKI STANDARD
SIST EN 1894:2005

01-september-2005

Sodobna tehniļ na keramika ï Mehanske lastnosti keramiļ nih kompozitov pri visoki temperaturi v pogojih inertne atmosfere ï Ugotavljanje striģne trdnosti s tlaļ no obremenitvijo zarezanih preskuģancev

Advanced technical ceramics - Mechanical properties of ceramic composites at high temperature under inert atmosphere - Determination of shear strength by compression loading of notched specimens

Hochleistungskeramik - Mechanische Eigenschaften von keramischen Verbundwerkstoffen bei hoher Temperatur in inerter Atmosphäre - Bestimmung der Scherfestigkeit durch Druckbeanspruchung von gekerbten Proben

Céramiques techniques avancées - Propriétés mécaniques des céramiques composites a haute température sous atmosphere neutre - Détermination de la résistance au cisaillement par compression d'éprouvettes entaillées

Ta slovenski standard je istoveten z: EN 1894:2005

ICS:

81.060.30	Sodobna keramika	Advanced ceramics

SIST EN 1894:2005 **en**

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 1894

April 2005

ICS 81.060.30

Supersedes ENV 1894:1996

English version

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This European Standard was approved by CEN on 15 March 2005.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Ref. No. EN 1894:2005: E

Contents

Foreword

This document (EN 1894:2005) has been prepared 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of an identical text or by endorsement, at the latest by October 2005, and conflicting national standards shall be withdrawn at the latest by October 2005.

This document supersedes ENV 1894:1996.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

This document specifies the conditions for determination of the inter-laminar shear strength of ceramic matrix composite materials with continuous fibre reinforcement for temperatures up to 2 000 °C under a vacuum, or a gas atmosphere, which is inert to the material under test, by loading of notched specimens in compression.

NOTE 1 The use of a vacuum or a gas atmosphere is aimed at avoiding changes of the material to be tested due to chemical reaction with its environment during the test.

This document applies to all ceramic matrix composites with continuous fibre reinforcement, unidirectional (1D), bidirectional (2D), and tridirectional (xD, with $2 < x < 3$), loaded along one principal axis of reinforcement.

NOTE 2 Care should be exercised in interpreting the results of the test method to obtain absolute values of the inter-laminar shear strength of ceramic matrix composites for design purposes.

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.

EN 60584-1, *Thermocouples; Part 1: Reference tables (IEC 60584-1:1995)*

EN 60584-2, *Thermocouples; Part 2: Tolerances (IEC 60584-2:1982 + A1:1989)*

EN ISO 7500-1, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tension/compression testing machines - Verification and calibration of the force-measuring system (ISO 7500-1:2004)*

ISO 3611, *Micrometer callipers for external measurement*

3 Definitions and symbols

For the purposes of this document, the following definitions and symbols apply.

3.1
test temperature, T
temperature at the centre of the test piece

3.2
shear failure force, F
maximum force required during a test carried out up to failure

3.3
interlaminar shear strength, $ILSS$
ratio calculated on the basis of the shear failure force and the shear loaded area

4 Principle

The test consists of measuring the force required to fracture a transversely notched test specimen of defined shape and dimensions, heated to the test temperature and subjected to compressive loading in direction 1 or 2, such that failure occurs in the form of inter-laminar shear in plane 12. The test is performed at constant crosshead displacement rate.

NOTE The test duration is limited to reduce creep effects.

5 Apparatus

5.1 Test machine

The test machine shall be equipped with a system for measuring the force applied to the test specimen conforming to grade 1 or better according to EN ISO 7500-1.

NOTE This prevails during actual test conditions, e.g. gas pressure, temperature.

5.2 Load train

The load train configuration shall allow alignment of the test specimen axis with the direction of the load. Care should be taken to maintain proper alignment of the specimen during loading and to avoid buckling of the specimen.

The load train performance including the alignment system and the force transmitting system, shall not change because of heating. Two techniques are possible:

— compression between platens without guide;

— compression between platens with a guiding tool.

The material of the tool shall be compatible with the test specimen material.

NOTE When specimens to be tested have a thickness less than 3 mm, the use of a guiding tool is recommended, to avoid buckling. This guide should not cause any parasitic effect during the test.

5.3 Test chamber

The test chamber shall be gas tight and shall allow proper control of the test specimen environment in the vicinity of the test specimen during the test.

The installation shall be such that a constant pressure can be maintained during the test.

Where a gas atmosphere is used, the gas atmosphere shall be chosen depending on the material to be tested and on test temperature. The level of pressure shall be chosen depending: on the material to be tested, on temperature and on the type of gas.

Where a vacuum chamber is used, the level of vacuum shall not induce chemical and/or physical instabilities of the test specimen material.

5.4 Set-up for heating

The set-up for heating shall be constructed in such a way that the variation of temperature within the shear-loaded area is less than 20 °C at test temperature.

5.5 Temperature measurement devices

For temperature measurement, either thermocouples conforming to EN 60584-1 and EN 60584-2 shall be used or, where thermocouples not conforming to EN 60584-1 and EN 60584-2 or pyrometers are used, calibration data shall be annexed to the test report.

5.6 Data recording system

A calibrated recorder may be used to record force-time curve. The use of a digital data recording system combined with an analogue recorder is recommended.

5.7 Micrometers

Micrometers used for the measurement of the dimensions of the test specimen shall conform to ISO 3611.

6 Test specimens

The test specimens are shown in Figures 1 and 2. A notch is machined on both sides. The recommended specimen dimensions are given in Tables 1 and 2. The notch spacing measured between the inner flanks of the notches (see Figure 1) shall be chosen, taking into account the requirements to obtain shear failure.

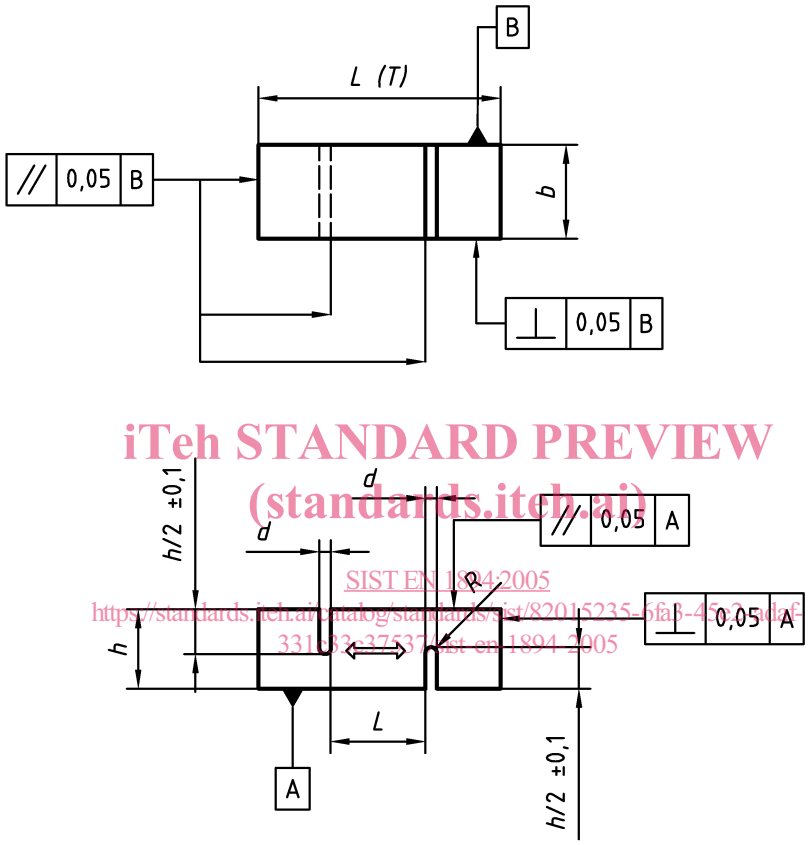

Figure 1 Test specimen geometry - I

Table 1 Test specimen dimensions - I

Dimensions in millimetres

	1D, 2D, and xD	Tolerance
L(T), total length	20 to 60	± 1
h, thickness	> 2	+ 0; -0,1
b, width	> 10	± 0,1
L, distance between notches	8 to 13	± 0,1
Notch depth	h/2 + 0,1	± 0,05
d, notch width	0,5 to 2	± 0,1
Parallelism of machined parts	0,05	

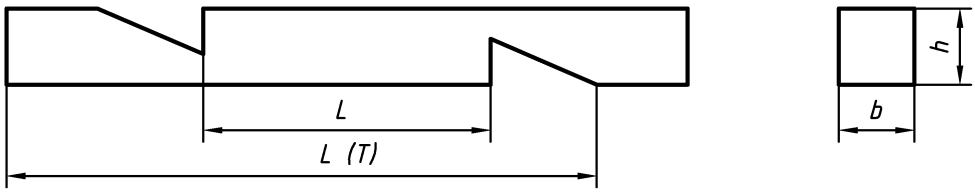

Figure 2 Test specimen geometry - II

Table 2 Test specimen dimensions - II

Dimensions in millimetres

	1D, 2D and xD	Tolerance
h, thickness	> 2	± 0,2
b, width	8 to 20	± 0,2
Parallelism of machined parts	0,05	

NOTE (Applies to Figures 1 and 2) If the proposed notch depth (h/2 + 0,1) does not lead to a rupture in a shear plane, then the depth of the notch can be increased to:

$$\frac{h\,(n+1)}{2n}$$

where

h is the thickness, in millimetres (mm);

n is the number of plies.

If the specimen is coated, the thickness of coating shall be added to the thickness.

7 Test specimen preparation

7.1 Machining and preparation

During cutting out, care shall be taken to align the test specimen axis with the desired fibre related loading axis.

Machining parameters that avoid damage to the material shall be established and documented. These parameters shall be adhered to during test specimen preparation.

7.2 Number of test specimens

At least five valid test results, as specified in 8.4, are required for any condition.