SLOVENSKI STANDARD
SIST ENV 1894:2000

01-december-2000

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

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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'éprouvette entaillée

Ta slovenski standard je istoveten z: **ENV 1894:1996**

ICS:

81.060.30	Sodobna keramika	Advanced ceramics

SIST ENV 1894:2000 **en**

EUROPEAN PRESTANDARD

PRÉNORME EUROPÉENNE

EUROPÄISCHE VORNORM

ENV 1894

May 1996

ICS 81.060.20

Descriptors: composite materials, reinforcing materials, ceramics, technical ceramics, mechanical properties, determination, shear strength, compression tests, high temperature tests, test atmospheres

English version

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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Contents

Foreword

This European Prestandard has been prepared by Technical Committee CEN/TC 184 "Advanced technical ceramics", the secretariat of which is held by BSI.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to annouce this European Prestandard : Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

This ENV 1894 specifies the conditions for determination of the interlaminar shear strength of ceramic matrix composite materials with continuous fibre reinforcement for temperatures up to 2 000 °C under vacuum or a gas atmosphere which is inert to the material under test, by loading of notched specimens in compression.

NOTE : The use of these environments is aimed at avoiding changes of the material to be tested due to chemical reaction with its environment during the test.

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

NOTE : Care should be exercised in interpreting the results of the proposed testing method to obtain absolute values of the interlaminar shear strength of ceramic matrix composites for design purpose.

2 Normative references

This European Pre-standard incorporates by dated or undated reference provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Pre-standard only when incorporated in it by amendment or revision. For undated references the latest edition of publication referred to, applies.

EN 60584-2	Thermocouples - Part 2 : Tolerances
EN 10002-2	Metallic materials - Tensile testing - Part 2 : Verification of the force measuring system of the tensile testing machines
HD 446-1S1	Thermocouples - Part 1 : Reference tables
ISO 3611	Micrometer callipers for external measurement

3 Principle

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

The test duration is limited to reduce creep effects.

4 Definitions and symbols

For the purposes of this pre-standard, the following definitions and symbols apply :

4.1 test temperature, T

Temperature at the centre of the test piece.

4.2 shear failure force, F

The maximum force required during a test carried out up to failure.

4.3 interlaminar shear strength, ILSS

Ratio calculated on the basis of the shear failure force and the shear loaded area.

5 Apparatus

5.1 Test machine

The machine shall be equiped with a system for measuring the force applied to the test specimen which shall conform to grade 1 or better according to EN 10002-2. This shall prevail during actual test conditions (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

Gas tight chamber which allows 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.

5.3.1 Gas atmosphere

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, on the type of gas.

5.3.2 Vacuum chamber

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

Thermocouples shall comply with HD 446-1S1 and EN 60584-2.

Alternatively, if pyrometers, or thermocouples which are not covered by HD 446-1S1 and EN 60584-2 are used, the 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 be in accordance with 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.

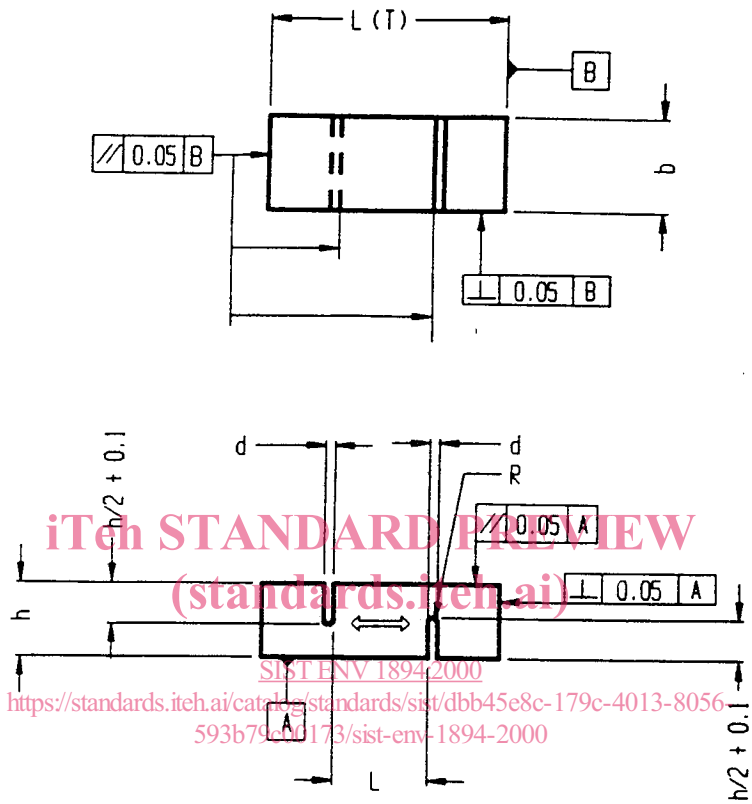

Figure 1

Table 1

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	