

**Advanced technical
ceramics —
Mechanical properties of
ceramic composites at high
temperature in air at
atmospheric pressure —
Determination of tensile
properties**

ICS 81.060.20

Committees responsible for this Draft for Development

The preparation of this Draft for Development was entrusted to Technical Committee RPI/13, Advanced technical ceramics, upon which the following bodies were represented:

AEA Technology
Aluminium Federation
British Ceramic Research Ltd.
British Industrial Ceramic Manufacturers Association
Department of Trade and Industry (National Physical Laboratory)
Institute of Refractories Engineers
Ministry of Defence
Refractories Association of Great Britain
Society of British Aerospace Companies Ltd.
University of Manchester

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National foreword

This Draft for Development has been prepared by Technical Committee RPI/13 and is the English language version of ENV 1893 : 1996 *Advanced technical ceramics — Mechanical properties of ceramic composites at high temperature in air at atmospheric pressure — Determination of tensile properties*, published as a European Prestandard by the European Committee for Standardization (CEN).

ENV 1893 : 1996 was produced as a result of international discussions in which the UK took an active part.

Cross-references

Publication referred to	Corresponding British Standard
EN 60584-2 : 1993	BS EN 60584 <i>Thermocouples</i> Part 2 : 1993 <i>Tolerances</i>
EN 10002-2	BS EN 10002 <i>Tensile testing of metallic materials</i> Part 2 : 1992 <i>Verification of the force measuring system of the tensile testing machine</i>
HD 446-1 S1	BS 4937 <i>International thermocouple reference tables</i> (Parts 1 to 7)

This publication is not to be regarded as a British Standard.

It is being issued in the Draft for Development series of publications and is of a provisional nature. It should be applied on this provisional basis, so that information and experience of its practical application may be obtained.

Comments arising from the use of this Draft for Development are requested so that UK experience can be reported to the European Organization responsible for its conversion to a European Standard. A review of this publication will be initiated 2 years after its publication by the European Organization so that a decision can be taken on its status at the end of its three-year life. The commencement of the review will be notified by an announcement in *BSI News*.

According to the replies received by the end of the review period, the responsible BSI committee will judge whether to support the conversion into a European Standard, extend the life of the prestandard or to withdraw it. Comments should be sent in writing to the Secretary of BSI Technical Committee RPI/13 at 389 Chiswick High Road, London W4 4AL quoting the document reference and clause number and proposing where possible, an appropriate revision of the text.

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Descriptors: Composite materials, reinforcing materials, ceramics, technical ceramics, mechanical properties, determination, tensile strength, tension tests, high temperature tests, atmospheric pressure

English version

Advanced technical ceramics — Mechanical properties of ceramic composites at high temperature in air at atmospheric pressure — Determination of tensile properties

Céramiques techniques avancées — Propriétés mécaniques des céramiques composites à haute température sous air à la pression atmosphérique — Détermination des caractéristiques en traction

Hochleistungskeramik — Mechanische Eigenschaften von keramischen Verbundwerkstoffen bei hoher Temperatur in Luft bei Atmosphärendruck — Bestimmung der Eigenschaften unter Zug

This European Prestandard (ENV) was approved by CEN on 1995-05-11 as a prospective standard for provisional application. The period of validity of this ENV is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the ENV can be converted into an European Standard (EN).

CEN members are required to announce the existence of this ENV in the same way as for an EN and to make the ENV available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the ENV) until the final decision about the possible conversion of the ENV into an EN is reached.

CEN members are the national standards bodies of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

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

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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 announce this European Prestandard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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1 Scope

This ENV 1893 specifies the conditions for determination of tensile properties of ceramic matrix composite materials with continuous fibre reinforcement for temperatures up to 1 700 °C in air at atmospheric pressure.

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

NOTE 1 : In most cases, ceramic matrix composites to be used at high temperature in air are coated with an anti oxidation coating.

NOTE 2 : The purpose of this standard is to determine the tensile properties of a material when it is placed under an oxidizing environment but not to measure material oxidation.

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
HTMTC ¹⁾	Code of practice - Code of practice for the measurement of misalignment induced bending in uniaxially loaded tension compression test pieces
ISO 3611	Micrometer callipers for external measurement

3 Principle

A test specimen of specified dimensions is heated to the testing temperature, and loaded in tension. The test is performed at constant crosshead displacement rate, or constant deformation rate (or constant loading rate). Force and longitudinal deformation are measured and recorded simultaneously.

The test duration is limited to reduce creep effects.

¹⁾ Published by JRC institute for Advanced Materials, ISBN 92-826-9681-2, EUR 16138 EN

NOTE : When constant loading rate is used in the non linear region of the tensile curve, only the tensile strength can be obtained from the test. In this region constant crosshead displacement rate or constant deformation rate is recommended to obtain the complete curve.

4 Definitions and symbols

For the purposes of this prestandard, the following definitions and symbols apply :

4.1 test temperature, T

Temperature of the test piece at the center of the gauge length.

4.2 calibrated length, l

The part of the test specimen which has uniform and minimum cross section area.

4.3 gauge length, L_0

Initial distance between reference points on the test specimen in the calibrated length. The temperature variation in the gauge length shall be within 20 °C at test temperature.

4.4 controlled temperature zone

The part of the calibrated length including the gauge length where temperature is within 50 °C of the test temperature.

4.5 initial cross section area, S_0

Initial cross section areas of the test specimen within the calibrated length, at test temperature.

Two initial cross section area of the test specimen can be defined :

- apparent cross section area : This is the total area of the cross section, $S_{0\text{ app}}$;
- effective cross section area : This is the total area corrected by a factor, to account for the presence of an antioxidative protection, $S_{0\text{ eff}}$.

4.6 longitudinal deformation, A

Increase in the gauge length between reference points under a tensile force. Its value corresponding to the maximum tensile force shall be denoted A_m .