

# Advanced technical ceramics — Ceramic composites — Thermophysical properties —

## Part 1: Determination of thermal expansion

The European Standard EN 1159-1:2003 has the status of a  
British Standard

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# National foreword

This British Standard is the official English language version of EN 1159-1:2003. It supersedes DD ENV 1159-1:1994 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee RPI/13, Advanced technical ceramics, which has the responsibility to:

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- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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### Summary of pages

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Détermination de la dilatation thermique

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Thermophysikalische Eigenschaften - Teil 1: Bestimmung  
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This European Standard was approved by CEN on 23 May 2003.

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## Foreword

This document (EN 1159-1:2003) 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of an identical text or by endorsement, at the latest by January 2004, and conflicting national standards shall be withdrawn at the latest by January 2004.

This document supersedes ENV 1159-1:1993.

EN 1159 'Advanced technical ceramics – Ceramic composites – Thermophysical properties' consists of four parts :

- *Part 1 : Determination of thermal expansion.*
- *Part 2 : Determination of thermal diffusivity.*
- *Part 3 : Determination of specific heat capacity.*
- *Part 4: Determination of thermal conductivity*

Annexes A and B are normative.

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

## 1 Scope

This Part of EN 1159 describes methods for the determination of linear thermal expansion characteristics of ceramic matrix composite materials up to 2 300 K, and is applicable to 1D, 2D and nD materials.

The method describes general principles of construction calibration and operation of the equipment.

## 2 Normative references

This European 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 Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 821-1, *Advanced technical ceramics - Monolithic ceramics - Thermo-physical properties - Part 1 : Determination of thermal expansion*.

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

EN ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025:1999)*

ISO 3611, *Micrometer callipers for external measurement*.

ISO 6906, *Vernier callipers reading to 0,02 mm*.

## 3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply.

### 3.1

#### **linear thermal expansion**

positive or negative change in one dimension that occurs when a material is subjected to a change in temperature

### 3.2

#### **linear thermal expansion coefficient at temperature T**

derivative of the length L with respect to temperature at the temperature T, divided by the length at temperature T

$$\alpha_T = \frac{1}{L} \left( \frac{dL}{dT} \right) T \quad (1)$$

### 3.3

#### **mean linear thermal expansion coefficient between temperatures T1 and T2**

linear thermal expansion between temperatures  $T_1$  and  $T_2$  divided by the temperature increment  $T_1$  to  $T_2$  and the length at temperature  $T_1$

$$\alpha(T_1, T_2) = \frac{L(T_2) - L(T_1)}{L(T_1) (T_2 - T_1)} \quad (2)$$

### 3.4

#### **representative volume element (R.V.E.)**

minimum volume which is representative of the material considered