International Standard

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Fine ceramics (advanced ceramics, advanced technical ceramics) — Ceramic composites — Notations and symbols

Céramiques techniques — Céramiques composites — Notations et symboles

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Foreword

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This document was prepared by Technical Committee ISO/TC 206, *Fine ceramics,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 184*, Advanced technical ceramics,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 19634:2017), which has been technically revised.

The main changes are as follows:

— revision and addition of certain symbols and notations.

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Fine ceramics (advanced ceramics, advanced technical ceramics) — Ceramic composites — Notations and symbols

1 Scope

This document specifies the symbols to be used to represent physical, mechanical and thermal characteristics, as determined by methods described in relevant International Standards, for ceramic matrix composites. This document also specifies the symbols used in undertaking measurements of these characteristics.

This document specifies symbols that are in accordance with the relevant parts of the ISO 80000 series where possible.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 80000-4, *Quantities and units — Part 4: Mechanics*

ISO 80000-5, *Quantities and units — Part 5: Thermodynamics*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 80000-4 and ISO 80000-5 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

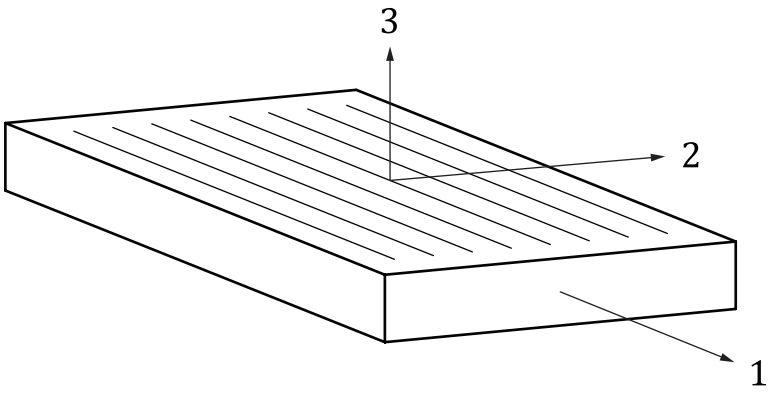
— IEC Electropedia: available at https://www.electropedia.org/

3.1
ceramic matrix composite
ceramic, carbon or glass matrix containing reinforcement distributed in one or more spatial directions

3.2
unidirectional ceramic matrix composite
1D material
ceramic matrix composite (3.1), the reinforcement of which is distributed in one single direction

Note 1 to entry: See Figure 1.

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Key

1 direction of reinforcement

2 direction of the greater transverse dimension (width), perpendicular to direction 1

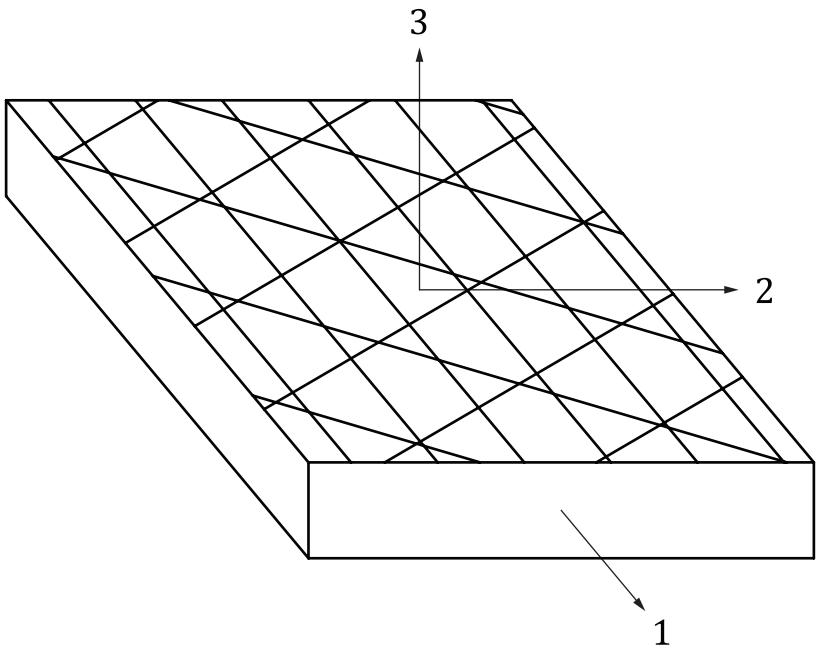
3 direction of the smaller transverse dimension (thickness), perpendicular to direction 1

NOTE When the width and the thickness are equal, then directions 2 and 3 are equivalent and can be chosen freely.

Figure 1 — Schematic diagram of a 1D material

3.3
in-plane reinforced ceramic matrix composite
2D material
ceramic matrix composite (3.1), where the reinforcements are placed along at least two directions in a single plane

Note 1 to entry: See Figure 2.



Key

1 direction of the greater fraction of reinforcement

2 direction perpendicular to direction 1 in the plane of reinforcement (not necessarily a direction of reinforcement)

3 direction perpendicular to the plane of reinforcement

NOTE Strictly more than one direction of fibrous reinforcement, all contained within one plane (in the present case, there are three directions of reinforcement in plane (1,2)).

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When several directions have an equal fraction of reinforcement, it shall be stated which direction is chosen as direction 1 in relation to the reinforcement structure (for example, orthogonal reinforced fabric: warp in direction 1, weft in direction 2).

Figure 2 — Schematic diagram of a 2D material

3.4
multidirectional ceramic matrix composite
***x*D (2 < *x* ≤ 3) material**
ceramic matrix composite (3.1), where the reinforcement is spatially distributed in at least three directions not in a single plane

Note 1 to entry: See Figures 3 and 4.

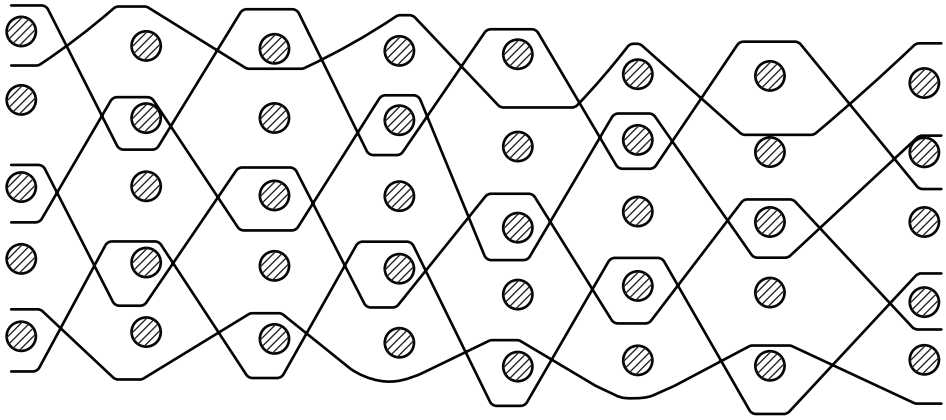
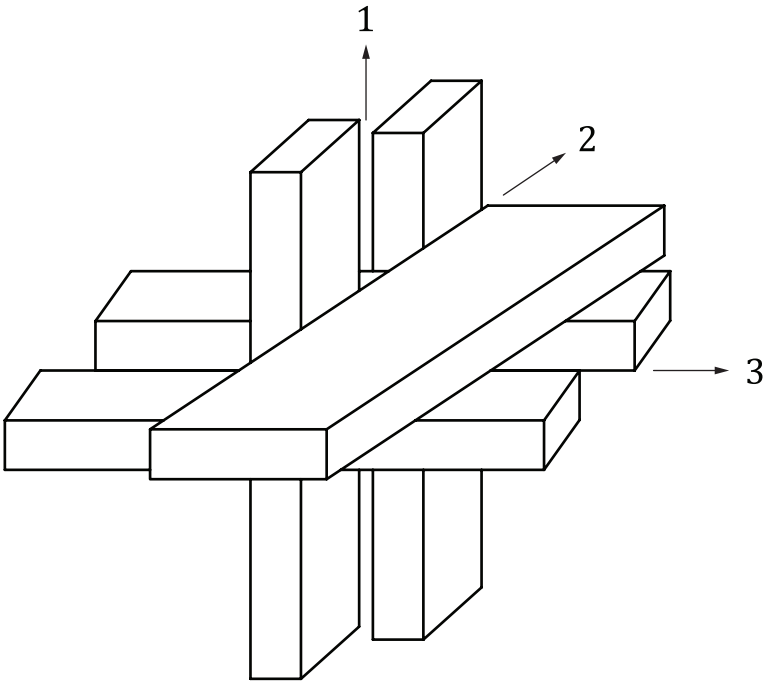


Figure 3 — Schematic diagram of a *x*D (2 < *x* ≤ 3) material

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Key

1 direction of the greater fraction of reinforcement

2 direction perpendicular to direction 1

3 direction perpendicular to the plane containing directions 1 and 2

When several directions have equal fraction of reinforcement, it shall be stated which direction is chosen as direction 1, in relation to the reinforcement structure. When it is possible to define a plane of reinforcement, direction 2 will be chosen in this plane perpendicular to direction 1(direction 2 is not necessarily a direction of reinforcement), and direction 3 will be perpendicular to the plane containing directions 1 and 2. When it is not possible to define a plane of reinforcement, direction 2 is chosen arbitrarily, but perpendicular to direction 1 and shall be clearly identified.

Figure 4 — Schematic diagram of a 3D material

4 Nomenclature and symbols

4.1 Nomenclature

Composites with continuous reinforcements constitute a specific class of these materials. Several subclasses of ceramic matrix composites with continuous reinforcements can be distinguished.

The symbol F/I/M applies usually to ceramic matrix composites:

— F indicates the chemical nature of fibrous reinforcement: C stands for carbon, SiC for silicon carbide, Al_2O_3 for alumina, etc.

— I indicates the chemical nature of fibre/matrix interphase: C stands for carbon, BN for boron nitride, $LaPO_4$ for monazite, etc.

— M indicates the chemical nature of matrix: C for carbon, SiC for silicon carbide, Al_2O_3 for alumina.

EXAMPLE 1 A ceramic matrix composite composed of a silicon carbide fibre, a carbon interphase and a silicon carbide matrix is denoted by SiC/C/SiC.

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