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Sodobna tehniļna keramika - Sistem simbolov in simboli

Advanced technical ceramics - Notations and symbols

Hochleistungskeramik - Benennungen und Formelzeichen

Céramiques techniques avancées - Notations et symboles

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ICS:

01.060	Veliļine in enote	Quantities and units
01.075	Simboli za znake	Character symbols
81.060.30	Sodobna keramika	Advanced ceramics

SIST-TP CEN/TR 13233:2007 **en**

TECHNICAL REPORT

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Advanced technical ceramics - Notations and symbols

Céramiques techniques avancées - Notations et symboles

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This Technical Report was approved by CEN on 25 December 2006. It has been drawn up by the Technical Committee CEN/TC 184.

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Contents

Page

Foreword

This document (CEN/TR 13233:2007) has been prepared by Technical Committee CEN/TC 184 “Advanced technical ceramics”, the secretariat of which is held by BSI.

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This document supersedes ENV 13233:1998.

1 Scope

This Technical Report defines the symbols to be used to represent physical, mechanical and thermal characteristics, as determined by methods described in relevant CEN publications, for advanced technical ceramics, including ceramic matrix composites. It is a guide for writing the symbols of quantities of these materials to avoid confusion in reporting measurements and characteristics of products.

Where possible, the definitions are in accordance with the relevant parts of ISO 31 and ISO 80000. In addition the symbols used in undertaking measurements of these characteristics are also defined.

2 Normative references

Not applicable.

3 Symbols, units and notations

3.1 General symbols

Contrary to monolithic materials, continuous fibre reinforced ceramic matrix composites show a directional dependence in their thermal and mechanical properties because of their anisotropic nature. A specific set of standards different from those for monolithic materials is required in order to characterize these properties, both at room temperature and at the anticipated high application temperatures. To allow adequate representation of the directional dependence, a notation convention is needed to identify the reinforcement directions in a right-hand orthogonal coordinate system for purposes of sampling test pieces and for the presentation of results.

3.2 Symbols and notations specific to ceramic matrix composites

The use of the subscripts 1, 2, 3 attached to the symbols used for mechanical properties makes it possible to define the mechanical characteristics of a material along one of its principal directions. The use of the subscripts (12, 13, 23) attached to the symbols used for mechanical properties makes it possible to give a material characteristics in one of the principal planes, for example:

$\sigma_{1,t,m}$: tensile strength in the 1 direction;

G_{12} : shear modulus in the 12 plane.

Figures 1 to 4 give examples of denotation on long fibre ceramic matrix composite materials.

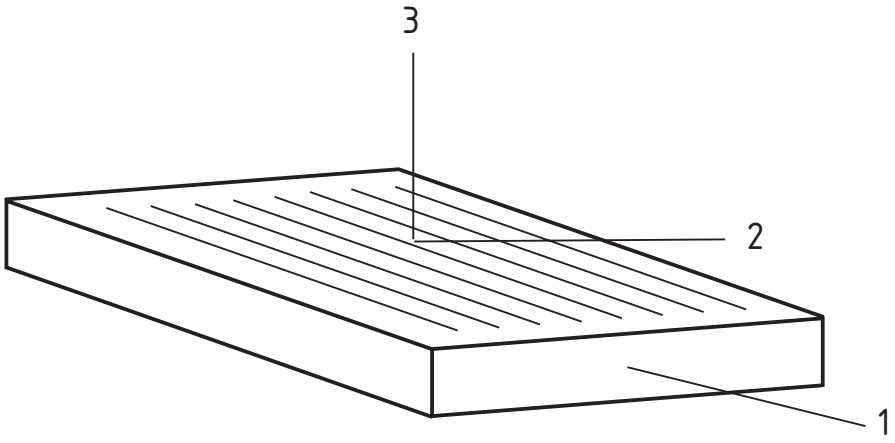

Figure 1 — Schematic diagram of a 1D material (see 3.2 for reference to axes 1, 2 and 3)

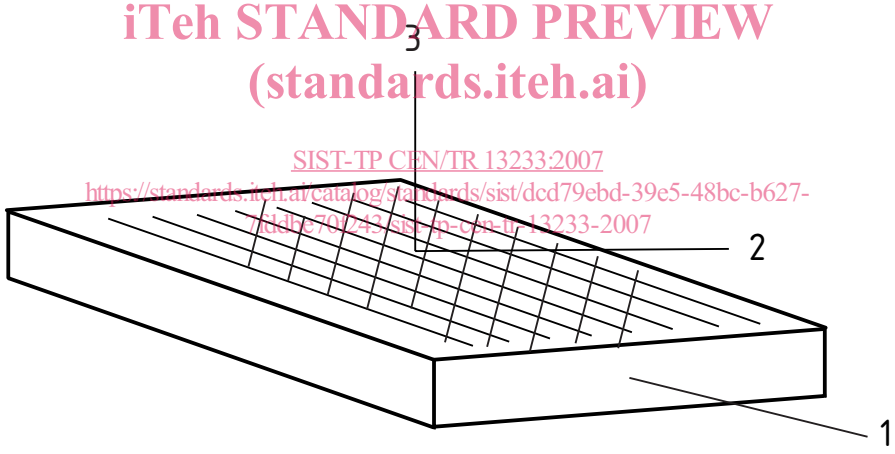

Figure 2 — Schematic diagram of a 2D material (see 3.2 for reference to axes 1, 2 and 3)

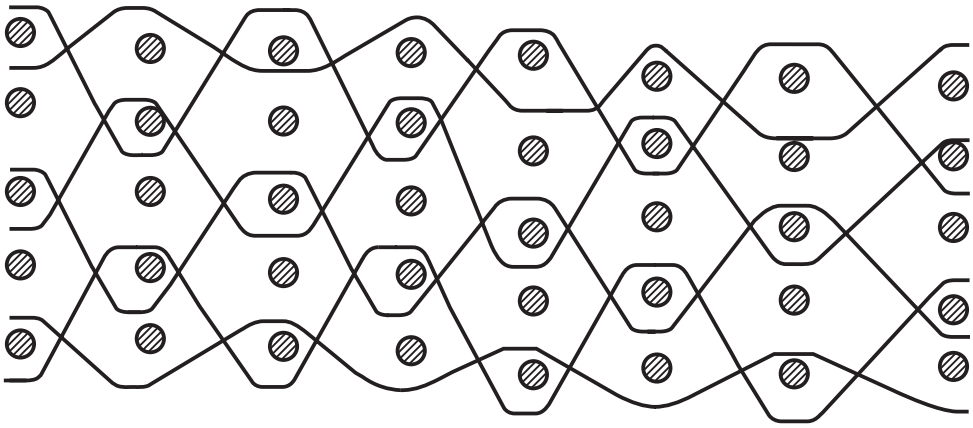

Figure 3 — Schematic diagram of an xD (2 < x ≤ 3) material

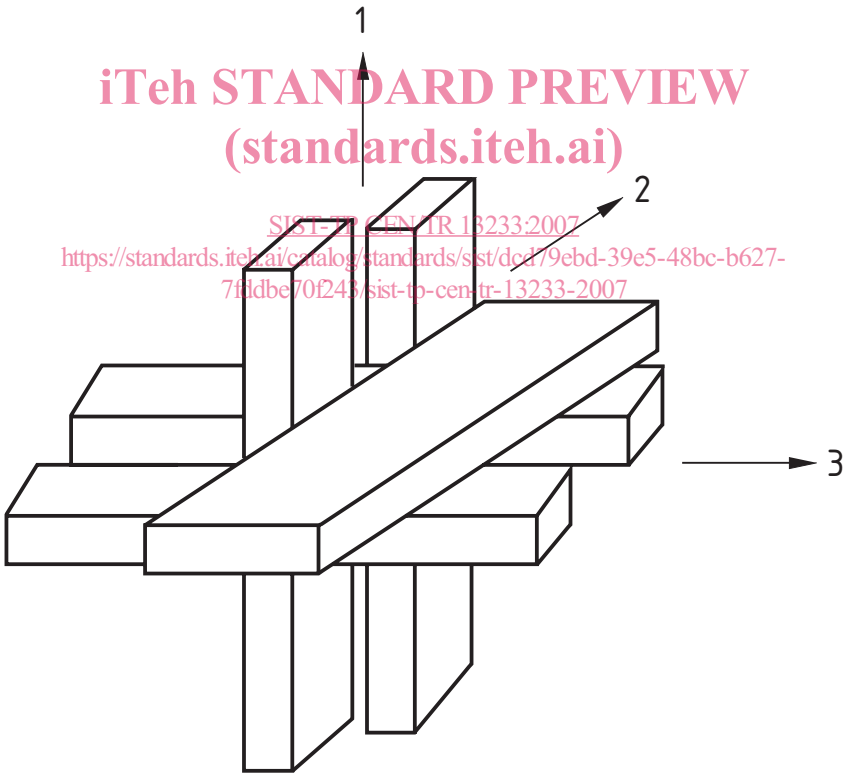

Figure 4 — Schematic diagram of a 3D material (see 3.2 for reference to axes 1, 2 and 3)

3.3 Symbols, definitions and units

Tables 1 to 4 give symbols, definitions and units generally used for quantities referred to in standards for advanced technical ceramics.

NOTE The quantities listed are referred to in the standards given in the final column of each table, although it is possible that the corresponding symbols have not been used. In this case, it is anticipated that they will be incorporated in the next revision of the standard.

Table 1 — Symbols related to physical quantities

Physical quantities					
Quantity	**Symbol**	**Definition**	**Unit**	**Remark**	**Relevant EN, ENV or CEN/TS**
Density	ρ	Ratio of the mass of a body to its volume	kg/m^3	Applies to true density of powders	623-2, 725-7, 1159-2
Apparent density	ρ_a	Ratio of the mass of the body to its total volume	kg/m^3	Applies to compacted powders	725-10
Bulk density	ρ_b	Ratio of the mass of the dry material of a porous body to its volume	kg/m^3	Applies also to tapped bulk density of powders	623-2, 725-8, 1389
Linear density	t	Ratio of the mass of a multifilament tow to its length	Tex	Tex is the mass in grams per 1 000 m	1007-2
Porosity	P	Ratio of the total volume of pores in a porous body to its total volume	-		623-2, 1389
Apparent porosity	P_a	Ratio of the volume of open pores to total volume	-		623-2, 1389
Grain size	g_{mli}	Mean linear intercept grain size determined either by the line or circle method applied to micrographs of polished cross-sections	µm		623-2
Phase volume fraction	$V_{f,j}$	Fractional volume of phase of type *j* determined from micrographs of polished cross-sections	-		623-5

Table 2 — Symbols related to geometrical quantities of test pieces

Geometrical quantities					
Quantity	**Symbol**	**Definition**	**Unit**	**Remark**	**Relevant EN, ENV or CEN/TS**
Length					
Total length	l, l_t	Total length of the test piece	mm		843-1, 843-2
Initial length	l_0	Initial length of test piece in thermal expansion measurement	mm		821-1
Gauge length	L_0	Initial distance between reference points on the test piece in the calibrated length	mm		658-1, 658-2, 1892, 1893
Distance between outer rollers	L_a	Outer support span in three or four-point bending configuration	mm	In flexural strength and modulus testing	658-3
Distance between inner rollers	L_i	Inner loading span in four-point bending configuration	mm	In flexural strength and modulus testing	821-1, 843-1, 843-2, 843-3, 658-3
Cross-section	A	Cross-section area	mm^2		
Initial cross-section area	A_0	Initial cross-section area of the test piece within the calibrated length at test temperature	mm^2		1892
NOTE 1 When the material is protected by a surface treatment, two initial cross-section areas can be defined:					
Apparent cross-section area	$A_{0,a}$	Geometrical area of the cross-section	mm^2		1893
Effective cross-section area	$A_{0,e}$	Geometrical area corrected by a factor, to account for the presence of a surface treatment	mm^2		1893
Distance between notches	L	In inter-laminar shear testing, the spacing between opposed notches	mm		658-4, 1894
Width and thickness					
Width	b	Width of a test piece (normal to loading direction in flexure)	mm		658-3, 843-1, 843-2, 1892