SLOVENSKI STANDARD
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Advanced technical ceramics - Ceramic composites - Notations and symbols

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Céramiques techniques avancées - Céramiques composites - Notations et symboles

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ICS:

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

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English version

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This European Prestandard (ENV) was approved by CEN on 10 August 1998 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 a European Standard.

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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 implement this European Standard : Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United-Kingdom.

1 Scope

This European Prestandard defines ceramic matrix composite materials with continuous reinforcements. This pre-standard specifies the notations to be used for the mutually perpendicular directions 1,2,3 of ceramic matrix composites. It sets the rules for writing the symbols and the quantities which characterise the mechanical and thermal properties of these materials.

This pre-standard explains how test specimens shall be taken from the material.

2 Normative references

This European pre-standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at 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.

ISO 31-3 Quantities and units - Part 3 : Mechanics

ISO 31-4 Quantities and units - Part 4 : Heat

3 Significance and use

3.1 Significance

Continuous fibre reinforced ceramic matrix composites show a directional dependence in the thermal and mechanical properties, because of their anisotropic nature. A specific set of standards is required in order to characterise these properties, both at room temperature and at the anticipated high application temperatures. Standards for mechanical testing at high temperatures are developed both for testing in air up to 1700 °C and under inert atmosphere up to 2000 °C. 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 specimens and for the presentation of the results.

3.2 Use

The use of the 1,2,3 subscripts attached to the symbols used for mechanical properties, makes it possible to give the mechanical characteristics of a material along one of its principal directions.

The use of couples of subscripts (12, 13, 23) attached to the symbols used for mechanical properties, makes it possible to give a material characteristic in one of the principal planes.

EXAMPLE : $\sigma_{1,t,m}$: tensile strength in the 1 direction
G_{12} : shear modulus in the 12 plane

4 Definitions

For the purposes of this European pre-standard, the definitions given in ISO 31-3 and ISO 31-4 and the following definitions apply :

4.1 ceramic matrix composites

Advanced technical ceramics are composed of a ceramic, carbon or glass matrix containing reinforcement distributed in one or more spatial directions. Composites with continuous reinforcements constitute a specific class of these materials. Several subclasses of ceramic matrix composites with continuous reinforcements can be distinguished :

4.1.1 unidirectional ceramic matrix composite (1D), (Figure 1)

Ceramic matrix composite, the reinforcement of which is distributed in one single direction. All reinforcements are placed along one direction, identified as direction 1. Direction 2 is the direction of the greater transverse dimension (width), perpendicular to direction 1. Direction 3 is the direction of the smaller transverse dimension (thickness), perpendicular to direction 1. When the width and the thickness are equal, then directions 2 and 3 are equivalent and may be chosen freely.

4.1.2 in plane reinforced ceramic matrix composite (2D), (Figure 2).

Ceramic matrix composite where the reinforcements are placed along at least two directions in a single plane. Direction 1 is the direction of the greater fraction of reinforcement. 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). Direction 2 is perpendicular to direction 1 in the plane of reinforcement (direction 2 is not necessarily a direction of reinforcement). Direction 3 is perpendicular to the plane of reinforcement.

4.1.3 multidirectional ceramic matrix composite(xD) with $2 < x \leq 3$, (Figures 3 and 4)

Ceramic matrix composite where the reinforcement is spatially distributed in at least three directions not in a single plane. Direction 1 is the direction of the greater fraction of reinforcement. 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.

4.1.4 principal axis of reinforcement

A principal axis of reinforcement corresponds to direction 1 or any reinforcement direction in the plane 1,2.

4.2 quantities, symbols and units

The symbols used for the various mechanical and thermal quantities are given in the following tables.

QUANTITY	SYMBOL	DEFINITION	UNIT	REMARK
GEOMETRICAL QUANTITIES				
Representative volume element	*R.V.E.*	The minimum volume which is representative of the material.		The R.V.E may be different for the application of different standards.
TEST SPECIMEN DIMENSIONS				
LENGTH				
Total length	l_t	Total length of the test specimen	mm	
Calibrated length	l	The part of the test specimen which has uniform and minimum cross-section area.	mm	
Gauge length	L_0	Initial distance between reference points on the test specimen in the calibrated length	mm	
Distance between notches	L		mm	For shear test.
WIDTH				
Width	b	Width of the test specimen in the calibrated length	mm	
When the material is protected by a surface treatment, two widths can be defined :				
Apparent width	B_a	Geometrical width	mm	
Effective width	B_e	Geometrical width corrected by a factor to account for the presence of a surface treatment	mm	
When width changes along the length, a numerical subscript is added to symbol b, b_1 is the width in the calibrated length, b_2, b_3, ... are the other widths.				

QUANTITY	SYMBOL	DEFINITION	UNIT	REMARK
THICKNESS				
Thickness	h	Thickness of the test specimen in the calibrated length	mm	
When the material is protected by a surface treatment, two thicknesses can be defined :				
Apparent thickness	h_a	Geometrical thickness	mm	
Effective thickness	h_e	Geometrical thickness corrected by a factor to account for the presence of a surface treatment	mm	
When thickness changes a long the length, a numerical subscript is added to symbol h, h_1 is the thickness in the calibrated length h_2, h_3, ... are the other thicknesses.				
DIAMETER				
Diameter	d	Diameter of the test specimen in the calibrated length	mm	$\varnothing$ is used in drawing
When the material is protected by a surface treatment, two diameters can be defined :				
Apparent diameter	d_a	Geometrical diameter	mm	
Effective diameter	d_e	Geometrical diameter corrected by a factor to account for the presence of a surface treatment	mm	
When diameter changes along the length, a numerical subscript is added to symbol d, d_1 is the diameter in the calibrated length, d_2, d_3 ..are the other diameters.				