SLOVENSKI STANDARD
SIST-TS CEN/TS 15867:2009

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Sodobna tehniļna keramika - Keramiļni kompoziti - Vodilo za ugotavljanje stopnje neporavnanosti pri enoosnih mehanskih preskusih

Advanced technical ceramics - Ceramic composites - Guide to the determination of the degree of misalignment in uniaxial mechanical tests

Hochleistungskeramik - Keramische Verbundwerkstoffe - Anleitung zur Bestimmung der Fluchtungsfehler bei mechanischen Prüfungen mit einachsiger Beanspruchung

Céramiques techniques avancées - Céramiques composites - Guide pour déterminer le degré de non-alignement des essais mécaniques uniaxiaux

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Advanced technical ceramics - Ceramic composites - Guide to the determination of the degree of misalignment in uniaxial mechanical tests

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Foreword

This document (CEN/TS 15867:2009) has been prepared by Technical Committee CEN/TC 184 “Advanced technical ceramics”, the secretariat of which is held by BSI.

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1 Scope

This Technical Specification provides guidance on:

— verifying the degree of misalignment of the load train of test machines, using a reference test specimen uniformly loaded in tension or in compression;

— correcting for defects caused by, e.g. torsion and bending.

This document is not intended to provide a quantitative and acceptable limit before the testing of ceramic matrix composites with a fibre reinforcement: unidirectional (1D), bidirectional (2D) and tridirectional (xD, with $2 < x \leq 3$) loaded along one principle axis of reinforcement. This limit depends on the sensitivity of each type of composite to the misalignment defect.

NOTE 1 This limit is to be defined between the testing establishment and the customer.

NOTE 2 Monolithic ceramics are very sensitive to misalignment defects, while ceramic matrix composites (CMCs) in general are moderately sensitive to them.

2 Normative references

The following referenced documents are indispensable for the application 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.

CEN/TR 13233:2007, *Advanced technical ceramics — Notations and symbols*

EN ISO 7500-1, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Verification and calibration of the force measuring system (ISO 7500-1:2004)*

EN ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025:2005)*

ISO 3611, *Micrometer callipers for external measurement*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in CEN/TR 13233:2007 and the following apply.

3.1
calibrated length
l
part of the reference test specimen which has a uniform and minimum cross section area

3.2
width
b
width of the reference test specimen in the calibrated length

3.3
thickness
h
thickness of the reference test specimen in the calibrated length

3.4 Type of defects

3.4.1
C type magnitude
Θ
angle between the loading axis of each of the two grips (see Figure 1)

3.4.2
S type magnitude
d
distance between the loading axis when they are parallel (see Figure 2)

3.4.3
torsion defect magnitude
Φ
angle between the gripping planes (see Figure 3)

4 Principle

A rectangular cross section of a reference test specimen equipped with 10 strain gauges is loaded in tension or in compression up to a load corresponding to 10 % of the nominal load capacity of the load cell used for the tests of CMCs. The stress corresponding to this value does not exceed 50 % of the elasticity limit of the material used for the reference test specimen. The readings obtained from the strain gauges bonded on the calibrated length of the reference test specimen allow the degree of misalignment to be determined.

The positioning of strain gauges is such that it indicates the magnitude of defects. These magnitudes permit the practical correction of the different types of defects:

— bending defects, either C (Figure 1) or S (Figure 2); or
— torsion (Figure 3).

Indications for correction are obtained by comparing the experimental readings of the strain gauges to values from charts established from numerical simulations.

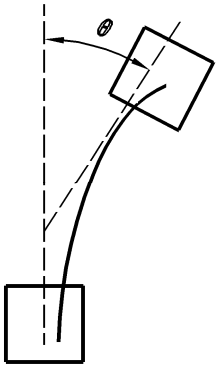


Figure 1 — C defect magnitude

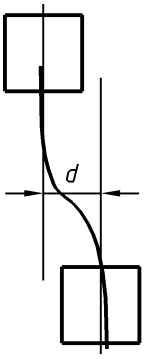
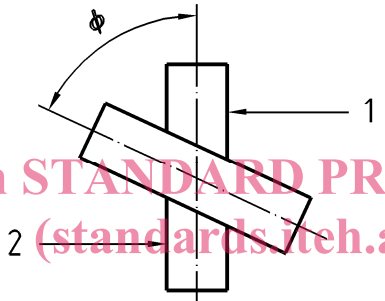


Figure 2 — S defect magnitude



Key

1 lower grip

2 upper grip

Figure 3 — Torsion defect magnitude

5 Apparatus

5.1 Test machine

The configuration of the test machine, including the load train and load cell shall be identical to the test machine used for the tests on the CMCs and shall be in accordance with EN ISO 7500-1.

5.2 Strain gauges

The principle of this method requires the use of strain gauges with an active surface equal to or smaller than 4 x 2 mm^2.

Furthermore, the distance between the edge of the test reference specimen and the longitudinal axis of the strain gauge shall be such as to avoid edge effects. A minimum distance of 2 mm is required.

Care shall be taken to ensure that the strain gauge readings are not influenced by the surface preparation and the adhesive used.

5.3 Data recording system

A calibrated recorder may be used to record load/strain curves. The use of a data recording system combined with an analogue recorder is recommended.

All strain measuring equipment and data acquisition systems shall be calibrated. They shall have an accuracy to within ± 0,5 % of the indicated reading or ± 3 microstrain, whichever is greater, and a resolution of 1 microstrain.

5.4 Micrometers

Micrometers used for the measurement of the dimensions of the reference test specimen shall be in accordance with ISO 3611.

6 Reference test specimens

The degree of misalignment of the load train of the test machine is verified by performing tests at room temperature with the following reference test specimen:

— dimensions: see Figure 4;

— material: steel ISO reference;

— location of the strain gauges: see Figure 4.

If another reference test specimen is used, it is necessary to establish a new series of charts.

Plan parallelism of the faces ≤ 0,02 mm.

Dimensions of the strain gauges, in millimetres: □ 4