SIST

SLOVENSKI STANDARD
oSIST prEN ISO 20504:2018

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Fina keramika (sodobna keramika, sodobna tehnična keramika) - Mehanske lastnosti keramičnih kompozitov pri sobni temperaturi - Določanje tlačnih lastnosti (ISO/DIS 20504:2017)

Fine ceramics (advanced ceramics, advanced technical ceramics) - Mechanical properties of ceramic composites at room temperature - Determination of compressive behaviour (ISO/DIS 20504:2017)

Hochleistungskeramik - Bestimmung der Eigenschaften unter Druck von endlosfaserverstärkten Verbundwerkstoffen bei Raumtemperatur (ISO/DIS 20504:2017)

Céramiques techniques - Propriétés mécaniques des composites céramiques à température ambiante - Détermination du comportement compressif (ISO/DIS 20504:2017)

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Fine ceramics (advanced ceramics, advanced technical ceramics) - Mechanical properties of ceramic composites at room temperature - Determination of compressive behaviour

Céramiques techniques — Propriétés mécaniques des composites céramiques à température ambiante - Détermination du comportement compressif

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Contents

Page

1 Scope 1
2 Normative references 1
3 Terms and definitions 1
4 Principle 3
5 Apparatus 3
5.1 Test machine 3
5.2 Load train 3
5.3 Strain measurement 4
5.3.1 General 4
5.3.2 Strain gauges 4
5.3.3 Extensometry 4
5.4 Data recording system 5
5.5 Dimension measuring devices 5
6 Test specimens 5
6.1 General 5
6.2 Compression between platens 5
6.3 Test specimen used with grips 7
7 Test specimen preparation 10
7.1 Machining and preparation 10
7.2 Number of test specimens 10
8 Test procedure 10
8.1 Test mode and rate 10
8.2 Measurement of test specimen dimensions 10
8.3 Buckling 10
8.4 Testing technique 11
8.4.1 Test specimen mounting 11
8.4.2 Extensometers 11
8.4.3 Measurements 11
8.5 Test validity 11
9 Calculation of results 12
9.1 Test specimen origin 12
9.2 Compressive strength 12
9.3 Strain at maximum compressive force 12
9.4 Proportionality ratio or pseudo-elastic modulus, elastic modulus 12
10 Test report 13
Annex A (informative) Illustration of elastic modulus 15

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

ISO 20504 was prepared by Technical Committee ISO/TC 206, *Fine ceramics*.

This second/third/... edition cancels and replaces the first/second/... edition (), [clause(s) / subclause(s) / table(s) / figure(s) / annex(es)] of which [has / have] been technically revised.

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Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 20504 was prepared by Technical Committee ISO/TC 206, *Fine ceramics*.

Fine ceramics (Advanced ceramics, Advanced technical ceramics) – Mechanical properties of ceramic composites at room temperature – Determination of compressive behaviour

1 Scope

This International Standard describes procedures for determination of the compressive behaviour of ceramic matrix composite materials with continuous fibre reinforcement at room temperature. This method applies to all ceramic matrix composites with a continuous fibre reinforcement, uni-directional (1D), bi-directional (2D) and tri-directional (xD, with $2 < x$ u 3), tested along one principal axis of reinforcement. This method may also be applied to carbon-fibre-reinforced carbon matrix composites (also known as: carbon/carbon or C/C). Two cases of testing are distinguished: compression between platens and compression using grips.

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.

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 3611, *Micrometer callipers for external measurements*

ISO 9513, *Metallic materials — Calibration of extensometers used in uniaxial testing*

ISO 14126, *Fibre-reinforced plastic composites — Determination of compressive properties in the in-plane direction*

ASTM E1012, *Standard Practice for Verification of Test Frame and Specimen Alignment Under Tensile and Compressive Axial Force Application*

ISO 17161, Fine ceramics (advanced ceramics, advanced technical ceramics) – ceramic composites – determination of the degree of misalignement in uniaxial mechanical tests.

ISO 14744 Fine ceramics (advanced ceramics, advanced technical ceramics)– Mechanical properties of ceramic composites at high temperature – Determination of compression properties.

3 Terms and definitions

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

3.1
calibrated length
part of the test specimen which has uniform and minimum cross-sectional area

3.2
initial gauge length
L_{o}
initial distance between reference points on the test specimen in the calibrated length before initiation of the test

3.3
final gauge length
L_f
final distance between reference points on the test specimen in the calibrated length at the completion of the test

3.4
initial cross-sectional area
A_o
initial area of specimen cross section in the calibration length

3.5
longitudinal deformation
ΔL
decrease of the initial gauge length under compressive force

NOTE The longitudinal deformation corresponding to the maximum force should be denoted as $\Delta L_{c,m}$.

3.6
compressive strain
ε
relative decrease of the gauge length defined as the ratio $\Delta L/L_o$

NOTE The compressive strain corresponding to the maximum force is denoted as $\varepsilon_{c,m}$.

3.7
compressive force
F_c
uniaxial compressive force carried by test specimen at any time during test

3.8
maximum compressive force
$F_{c,m}$
greatest uniaxial compressive force applied to test specimen when tested to failure

3.9
compressive stress
σ
compressive force supported by the test specimen at any time in the test divided by the initial cross-sectional area such that $\sigma = F_c/A_o$

3.10
compressive strength
$S_{c,m}$
greatest compressive stress applied to a test specimen when tested to failure

3.11
proportionality ratio or pseudo-elastic modulus
E_p
slope of the linear region of the stress-strain curve, if any

NOTE Examination of the stress-strain curves for ceramic matrix composites allows definition of the following cases:

— Material with a linear region in the stress-strain curve.

For ceramic matrix composites that have a mechanical behaviour characterised by a linear region, the proportionality ratio E_p is defined as:

$$E_p(\sigma_1, \sigma_2) = \frac{\sigma_2 - \sigma_1}{\varepsilon_2 - \varepsilon_1} \qquad (1)$$

where (ε_1, σ_1) and (ε_2, σ_2) lie near the lower and the upper limits of the linear region of the stress-strain curve (see Figures A.1 and A.2).

— Material with non-linear region in the stress-strain curve. In this case only, stress-strain couples can be determined at specified stresses or specified strains.

3.12
elastic modulus
E
proportionality ratio or pseudo-elastic modulus, in the special case where the linearity starts near the origin

See Figure A.2.

4 Principle

A test specimen of specified dimensions is loaded in compression. The compression test is usually performed at a constant cross-head displacement rate or at a constant deformation rate.

NOTE Constant force rate is only allowed in the case of linear stress-strain behaviour up to failure.

For crosshead displacement tests, a constant rate is recommended when the test is conducted to failure.

The force and longitudinal deformation are measured and recorded simultaneously.

5 Apparatus

5.1 Test machine

The machine shall be equipped with a system for measuring the force applied to the test specimen that shall conform to grade 1 or better in accordance with ISO 7500-1.

5.2 Load train

The load train is composed of movable and fixed cross-heads, the loading rods and the grips or platens. Load train couplers may additionally be used to connect the grips or platens to the loading rods.

The load train shall align the test specimen axis with the direction of force application without introducing bending or torsion in the test specimen. The misalignment of the test specimen shall be verified and documented in accordance with the procedure described in ISO 17161. The maximum percent bending shall not exceed 5 % at an average axial strain of 500×10^{-6}.

There are two alternative means of force application:

a) Compression platens are connected to the force transducer and the moving cross-head. The parallelism of these platens shall be better than 0,01 mm, in the loading area and the faces of the platens shall be perpendicular to the force application direction.