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Fine ceramics (advanced ceramics, advanced technical ceramics) — Mechanical properties of ceramic composites at elevated temperature in air atmospheric pressure — Determination of in-plane shear strength

Céramiques techniques (céramiques avancées, céramiques techniques avancées) — Propriétés mécaniques des composites céramiques à température élevée sous air à pression atmosphérique — Détermination de la résistance au cisaillement dans le plan

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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.

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

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Fine ceramics (advanced ceramics, advanced technical ceramics) — Mechanical properties of ceramic composites at elevated temperature in air atmospheric pressure — Determination of in-plane shear strength

1 Scope

This document specifies a method for the determination of in-plane shear strength of continuous fibre-reinforced ceramic composites at elevated temperature in air or inert atmosphere by the asymmetric four-point bending test on double-edge notched specimens. The shear strength in plane (1,2) can be evaluated, where direction 1 is that of the greater fraction of reinforcement and direction 2 is perpendicular to direction 1. Methods for test piece fabrication, testing modes and rates (load or displacement rate), data collection and reporting procedures are addressed.

This document applies to all ceramic matrix composites with continuous fibre-reinforcement: unidirectional (1D), bidirectional (2D) and tridirectional (xD, with $2 < x \leq 3$).

This document is for material development, material comparison, quality assurance, characterization, reliability and design data generation.

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 3611, *Geometrical product specifications (GPS) — Dimensional measuring equipment: Micrometers for external measurements — Design and metrological characteristics*

ISO 7500-1, *Metallic materials — Calibration and verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Calibration and verification of the force-measuring system*

ISO 19634, *Fine ceramics (advanced ceramics, advanced technical ceramics) — Ceramic composites — Notations and symbols*

ISO 20507, *Fine ceramics (advanced ceramics, advanced technical ceramics) — Vocabulary*

IEC 60584-1, *Thermocouples — Part 1: Reference tables*

IEC 60584-2, *Thermocouples — Part 2: Tolerances*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 19634 and ISO 20507 and the following apply.

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

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

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

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3.1
initial gauge section
S_0
initial area of test piece between notch roots

3.2
test temperature
T
temperature measured at the centre of the gauge section

3.3
applied force
F
force applied to a test piece

3.4
shear failure force
F_{max}
maximum force required to fracture a shear-loaded test piece

3.5
shear strength
τ_m
maximum shear stress which a material is capable of sustaining

Note 1 to entry: Shear strength is calculated from the shear failure force and the gauge section.

3.6
inner span
L_i
centre distance between two inner loading pins

3.7
outer span
L_a
centre distance between two outer loading pins

4 Principle

The in-plane shear strength of continuous fibre-reinforced ceramic composites, as determined by this document, is measured by the asymmetric four-point bending test at elevated temperature in air or inert atmosphere. According to this test, the shear strength is determined by loading a test coupon in the form of a rectangular flat strip with symmetric, centrally located V-notches using a mechanical testing machine and an asymmetric four-point bending fixture. Failure of the test piece occurs by shear force between the V-notches. Schematics of the test set-up and the test piece are shown in Figures 1 and 2, respectively. The free body, bending moment and shear force diagrams by the asymmetric four-point bending flexure are illustrated in Figure 3.

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