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Advanced technical ceramics – Test methods for determination of fracture toughness of monolithic ceramics – Part 1:Guide to test method selection

Céramiques techniques avancées

Hochleistungskeramik – Prüfverfahren zur Bestimmung der Bruchzähigkeit von monolithischer Keramik – Teil 1: Leitlinie zur Auswahl des Prüfverfahrens

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Foreword

This document (CEN/TS 14425-1:2003) has been prepared by Technical Committee CEN/TC 184 “Advanced technical ceramics”, the secretariat of which is held by BSI.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

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CEN/TS 14425 'Advanced technical ceramics — Test methods for determination of fracture toughness of monolithic ceramics' consists of five parts:

Part 1: *Guide to test method selection*

Part 2: *Single-edge pre-cracked beam (SEPB) method*

Part 3: *Chevron notched beam (CNB) method*

Part 4: *Surface crack in flexure (SCF) method*

Part 5: *Single-edge vee-notch beam (SEVNB) method*

1 Scope

1.1 This part of CEN/TS 14425 provides information on the comparative value, and guidance on the selection, of test methods for determining the apparent fracture toughness of monolithic advanced technical ceramics. For the purposes of this Technical Specification, the term monolithic includes particle, platelet and whisker reinforced advanced technical ceramics which can be regarded as macroscopically homogeneous. It does not include long-fibre reinforced ceramics.

1.2 Reference is made in this part of CEN/TS 14425 to specific test methods described in other parts of this Technical Specification.

2 Normative references

This Technical Specification incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the 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 Technical Specification only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 843-1 Advanced technical ceramics - Monolithic ceramics - Mechanical properties at room temperature: Part 1: Determination of flexural strength.

3 Terms and definitions

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

3.1
stress intensity factor (*K*)
magnitude of the factor determining the ideal crack tip stress field (a stress-field singularity) for a particular mode in a homogeneous linear-elastic body. This Technical Specification deals primarily with opening mode behaviour, K_I.

3.2
critical stress intensity factor (K_c)
magnitude of the stress intensity factor required to cause a crack to propagate at high velocity.

3.3
crack extension resistance
resistance to propagation of a crack expressed as either (1) the stress intensity factor for crack propagation (commonly referred to as fracture toughness), or (2) the force per unit crack width required to extend a crack, or (3) the value of *J*, the so-called J-integral.

3.4
fracture toughness
resistance displayed by a material to the propagation of a crack through it.

NOTE This term should normally be qualified with the conditions under which the test is performed since the value obtained may depend on the crack size, geometry, stress field, crack velocity and test method.

3.5
apparent fracture toughness
fracture toughness determined by a particular method under the conditions imposed by that method.

3.6
work of fracture
external mechanical work performed on a test piece to produce unit area of new macroscopic crack face.

3.7
plane-strain fracture toughness
fracture toughness under conditions of crack tip plane-strain, i.e. where all strains are confined to a plane normal to the crack front and containing the crack propagation direction.

3.8
stable crack growth
growth of a crack under known and controlled conditions by virtue of the experimental technique employed.

3.9
unstable crack growth
growth of a crack under conditions where the acceleration of the crack front is uncontrolled by virtue of the experimental technique employed.

3.10
pop-in
sudden jump of a pre-existing crack front from an initial position or the development of a new crack to a stable position on application of a force without catastrophic failure of the test-piece.

3.11
R-curve
plot of crack extension resistance as a function of stable crack extension.