Irish Standard
I.S. EN 820-5:2009

Advanced technical ceramics - Thermomechanical properties of monolithic ceramics - Part 5: Determination of elastic moduli at elevated temperatures

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NSAI
1 Swift Square,
Northwood, Santry
Dublin 9

T +353 1 807 3800
F +353 1 807 3838
E standards@nsai.ie
W **NSAI.ie**

Sales:
T +353 1 857 6730
F +353 1 857 6729
W standards.ie

Price Code:
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English Version

Advanced technical ceramics - Thermomechanical properties of monolithic ceramics - Part 5: Determination of elastic moduli at elevated temperatures

Céramiques techniques avancées - Propriétés thermomécaniques des céramiques monolithiques - Partie 5 : Détermination des modules élastiques à température élevées

Hochleistungskeramik - Thermomechanische Eigenschaften monolithischer Keramik - Teil 5: Bestimmung der elastischen Moduln bei erhöhten Temperaturen

This European Standard was approved by CEN on 12 June 2009.

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Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (EN 820-5:2009) has been prepared by Technical Committee CEN/TC 184 “Advanced technical ceramics”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2010, and conflicting national standards shall be withdrawn at the latest by January 2010.

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

This document supersedes CEN/TS 820-5:2004.

EN 820 consists of five parts, under the general title "Advanced technical ceramics - Methods of testing monolithic ceramics - Thermomechanical properties":

— Part 1: Determination of flexural strength at elevated temperatures

— Part 2: Determination of self-loaded deformation

— Part 3: Determination of resistance to thermal shock by water quenching

— Part 4: Determination of flexural creep deformation at elevated temperatures

— Part 5: Determination of elastic moduli at elevated temperatures

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1 Scope

This part of EN 820 describes methods for determining the elastic moduli, specifically Young's modulus, shear modulus and Poisson's ratio, of advanced monolithic technical ceramics at temperatures above room temperature. The standard prescribes three alternative methods for determining some or all of these three parameters:

A the determination of Young's modulus by static flexure of a thin beam in three- or four-point bending.

B the determination of Young's modulus by forced longitudinal resonance, or Young's modulus, shear modulus and Poisson's ratio by forced flexural and torsional resonance, of a thin beam.

C the determination of Young's modulus from the fundamental natural frequency of a struck bar (impulse excitation method).

This part of EN 820 extends the above-defined room-temperature methods described in EN 843-2 to elevated temperatures. All the test methods assume the use of homogeneous test pieces of linear elastic materials. The test assumes that the test piece has isotropic elastic properties. At high porosity levels all of the methods can become inappropriate. The maximum grain size (see EN 623-3), excluding deliberately added whiskers, should be less than 10 % of the minimum dimension of the test piece.

NOTE 1 Method C in EN 843-2 based on ultrasonic time of flight measurement has not been incorporated into this part of EN 820. Although the method is feasible to apply, it is specialised, and outside the capabilities of most laboratories. There are also severe restrictions on test piece geometries and methods of achieving pulse transmission. For these reasons this method has not been included in EN 820-5.

NOTE 2 The upper temperature limit for this test depends on the properties of the test pieces, and can be limited by softening within the timescale of the test. In addition, for method A there can be limits defined by the choice of test jig construction materials.

NOTE 3 Methods B and C may not be appropriate for materials with significant levels of porosity (i.e. > 15 %) which cause damping and an inability to detect resonances or natural frequencies, respectively.

NOTE 4 This method does not provide for the effects of thermal expansion, i.e. the measurements are based on room temperature dimensions. Depending upon the use to which the data are put, it can be necessary to make a further correction by multiplying each dimensional factor in the relevant equations by a factor $(1 + \overline{\alpha}\,\Delta T)$ where $\overline{\alpha}$ is the mean linear expansion coefficient over the temperature interval ΔT from room temperature.

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.

EN 820-1, *Advanced technical ceramics — Method of testing monolithic ceramics — Thermo-mechanical properties — Part 1: Determination of flexural strength at elevated temperatures*

EN 843-1:2006, *Advanced technical ceramics — Mechanical properties of monolithic ceramics at room temperature — Part 1: Determination of flexural strength*

EN 60584-2, *Thermocouples — Part 2: Tolerances (IEC 60584-2:1982 + A1:1989)*

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)*