Advanced technical ceramics - Mechanical properties of ceramic composites at room temperature - Determination of elastic properties by an ultrasonic technique

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EESTI STANDARDI EESSÕNA **NATIONAL FOREWORD**

Käesolev Eesti standard EVS-EN 14186:2007 sisaldab Euroopa standardi EN 14186:2007 ingliskeelset teksti. Käesolev dokument on jõustatud 18.12.2007 ja selle kohta on avaldatud teade Eesti standardiorganisatsiooni ametlikus väljaandes. Standard on kättesaadav Eesti standardiorganisatsioonist.	This Estonian standard EVS-EN 14186:2007 consists of the English text of the European standard EN 14186:2007. This document is endorsed on 18.12.2007 with the notification being published in the official publication of the Estonian national standardisation organisation. The standard is available from Estonian standardisation organisation.

Käsitlusala: This European Standard specifies an ultrasonic method to determine the components of the elasticity tensor of ceramic matrix composite materials at room temperature. Young's moduli, shear moduli and Poisson coefficients, can be determined from the components of the elasticity tensor. This European Standard applies to ceramic matrix composites with a continuous fibre reinforcement: unidirectional (1D), bidirectional (2D), and tridirectional (×D, with 2 < × ≤ 3) which have at least orthotropic symmetry, and whose material symmetry axes are known. This method is applicable only when the ultrasonic wave length used is larger than the thickness of the representative elementary volume, thus imposing an upper limit to the frequency range of the transducers used. NOTE Properties obtained by this method might not be comparable with moduli obtained by EN 658-1, EN 658-2 and EN 12289.	**Scope:** This European Standard specifies an ultrasonic method to determine the components of the elasticity tensor of ceramic matrix composite materials at room temperature. Young's moduli, shear moduli and Poisson coefficients, can be determined from the components of the elasticity tensor. This European Standard applies to ceramic matrix composites with a continuous fibre reinforcement: unidirectional (1D), bidirectional (2D), and tridirectional (×D, with 2 < × ≤ 3) which have at least orthotropic symmetry, and whose material symmetry axes are known. This method is applicable only when the ultrasonic wave length used is larger than the thickness of the representative elementary volume, thus imposing an upper limit to the frequency range of the transducers used. NOTE Properties obtained by this method might not be comparable with moduli obtained by EN 658-1, EN 658-2 and EN 12289.

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Advanced technical ceramics - Mechanical properties of ceramic composites at room temperature - Determination of elastic properties by an ultrasonic technique

Céramiques techniques avancées - Propriétés mécaniques des céramiques composites à température ambiante - Détermination des propriétés élastiques par une méthode ultrasonore

Hochleistungskeramik - Mechanische Eigenschaften keramischer Verbundwerkstoffe bei Raumtemperatur - Bestimmung von elastischen Eigenschaften mittels Ultraschallwellen

This European Standard was approved by CEN on 13 October 2007.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Contents

Foreword

This document (EN 14186:2007) 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 May 2008, and conflicting national standards shall be withdrawn at the latest by May 2008.

This document supersedes ENV 14186:2002.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

This European Standard specifies an ultrasonic method to determine the components of the elasticity tensor of ceramic matrix composite materials at room temperature. Young's moduli, shear moduli and Poisson coefficients, can be determined from the components of the elasticity tensor.

This European Standard applies to ceramic matrix composites with a continuous fibre reinforcement: unidirectional (1D), bidirectional (2D), and tridirectional ($\times$D, with $2 < \times \leq 3$) which have at least orthotropic symmetry, and whose material symmetry axes are known.

This method is applicable only when the ultrasonic wave length used is larger than the thickness of the representative elementary volume, thus imposing an upper limit to the frequency range of the transducers used.

NOTE Properties obtained by this method might not be comparable with moduli obtained by EN 658-1, EN 658-2 and EN 12289.

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 1389, *Advanced technical ceramics — Ceramic composites — Physical properties — Determination of density and apparent porosity*

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

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

ISO 3611, *Micrometer callipers for external measurements*

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
stress-strain relations for orthotropic material
elastic anisotropic behaviour of a solid homogeneous body described by the elasticity tensor of fourth order C_{ijkl}, represented in the contracted notation by a symmetrical square matrix (6×6)

NOTE 1 If the material has at least orthotropic symmetry, its elastic behaviour is fully characterised by nine independent stiffness components C_{ij}, of the stiffness matrix (C_{ij}), which relates stresses to strains, or equivalently by nine independent compliance components S_{ij} of the compliance matrix (S_{ij}), which relates strains to stresses. The stiffness and compliance matrices are the inverse of each other.

If the reference coordinate system is chosen along the axes of symmetry, the stiffness matrix C_{ij} and the compliance matrix S_{ij} can be written as follows: