



National Standards Authority of Ireland

IRISH STANDARD

**I.S. ENV 14186:2002**

ICS 81.060.30

**ADVANCED TECHNICAL CERAMICS -  
CERAMIC COMPOSITES - MECHANICAL  
PROPERTIES AT ROOM TEMPERATURE,  
DETERMINATION OF ELASTIC PROPERTIES  
BY AN ULTRASONIC TECHNIQUE**

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EUROPEAN PRESTANDARD  
PRÉNORME EUROPÉENNE  
EUROPÄISCHE VORNORM

**ENV 14186**

August 2002

ICS 81.060.30

English version

**Advanced technical ceramics - Ceramic composites -  
Mechanical properties at room temperature, determination of  
elastic properties by an ultrasonic technique**

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

This European Prestandard (ENV) was approved by CEN on 13 July 2001 as a prospective standard for provisional application.

The period of validity of this ENV is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the ENV can be converted into a European Standard.

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
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## **Foreword**

This document (ENV 14186:2002) has been prepared by Technical Committee CEN/TC 184 "Advanced technical ceramics", the secretariat of which is held by BSI.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this European Prestandard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

## ENV 14186:2002 (E)

### 1 Scope

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

This standard applies to ceramic matrix composites with a continuous fibre reinforcement: unidirectional (1D), bidirectional (2D), and tridirectional (xD, with  $2 < x \leq 3$ ) 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 may not be comparable with moduli obtained by EN 658-1, ENV 658-2 and ENV 12289.

### 2 Normative references

This European Prestandard 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 European Prestandard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

ENV 1389, *Advanced technical ceramics – Composite ceramics – Physical properties – Determination of density and of apparent porosity.*

ENV 13233:1998, *Advanced technical ceramics – Composite ceramics – Notations and symbols.*

ISO 3611, *Micrometer callipers for external measurements.*

ISO 653, *Long-solid-stem thermometers for precision use.*

### 3 Principle

The determination of the elastic properties consists of calculating the coefficients of the propagation equation of an elastic plane wave, from a set of properly chosen velocity measurements along known directions.

A thin specimen with planparallel faces is immersed in an acoustically coupling fluid (e.g. water) – see Figure 1. The specimen is placed between an emitter (E) and a receiver (R) which are rigidly connected to each other and have two rotational degrees of freedom. Using appropriate signal processing, the propagation velocities of each wave in the specimen are calculated.

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