National Standards Authority of Ireland

IRISH STANDARD

I.S. EN 843-5:2006

ICS 81.060.30

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ADVANCED TECHNICAL CERAMICS - MECHANICAL PROPERTIES OF MONOLITHIC CERAMICS AT ROOM TEMPERATURE - PART 5: STATISTICAL ANALYSIS

This Irish Standard was published under the authority of the National Standards Authority of Ireland and comes into effect on:

7 February 2007

Price Code N

Údarás um Chaighdeáin Náisiúnta na hÉireann

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 843-5

December 2006

ICS 81.060.30

Supersedes ENV 843-5:1996

English Version

Advanced technical ceramics - Mechanical properties of monolithic ceramics at room temperature - Part 5: Statistical analysis

Céramiques techniques avancées - Propriétés mécaniques des céramiques monolithiques à température ambiante - Partie 5: Analyse statistique

Hochleistungskeramik - Mechanische Eigenschaften monolithischer Keramik bei Raumtemperatur - Teil 5: Statistische Auswertung

This European Standard was approved by CEN on 11 November 2006.

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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 Central Secretariat has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Ref. No. EN 843-5:2006: E

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Foreword

This document (EN 843-5:2006) 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of an identical text or by endorsement, at the latest by June 2007, and conflicting national standards shall be withdrawn at the latest by June 2007.

This document supersedes ENV 843-5:1996.

EN 843 *Advanced technical ceramics — Mechanical properties of monolithic ceramics at room temperature* comprises six parts:

Part 1: *Determination of flexural strength*

Part 2: *Determination of Young's modulus, shear modulus and Poisson's ratio*

Part 3: *Determination of subcritical crack growth parameters from constant stressing rate flexural strength tests*

Part 4: *Vickers, Knoop and Rockwell superficial hardness*

Part 5: *Statistical analysis*

Part 6: *Guidance for fractographic investigation*

At the time of publication of this Revision of Part 5, Part 6 was available as a Technical Specification.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, 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 part of EN 843 specifies a method for statistical analysis of ceramic strength data in terms of a two-parameter Weibull distribution using a maximum likelihood estimation technique. It assumes that the data set has been obtained from a series of tests under nominally identical conditions.

NOTE 1 In principle, Weibull analysis is considered to be strictly valid for the case of linear elastic fracture behaviour to the point of failure, i.e. for a perfectly brittle material, and under conditions in which strength limiting flaws do not interact and in which there is only a single strength-limiting flaw population.

If subcritical crack growth or creep deformation preceding fracture occurs, Weibull analysis can still be applied if the results fit a Weibull distribution, but numerical parameters may change depending on the magnitude of these effects. Since it is impossible to be certain of the degree to which subcritical crack growth or creep deformation has occurred, this European Standard permits the analysis of the general situation where crack growth or creep may have occurred, provided that it is recognized that the parameters derived from the analysis may not be the same as those derived from data with no subcritical crack growth or creep.

NOTE 2 This European Standard employs the same calculation procedures as method A of ISO 20501:2003 [1], but does not provide a method for dealing with censored data (method B of ISO 20501).

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

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 843-1:2006 and the following apply.

NOTE Definitions of additional statistical terms can be found in ISO 2602 [2], ISO 3534-1 [3], or other source literature on statistics.

3.1 Flaws

3.1.1
flaw
inhomogeneity, discontinuity or structural feature in a material which when loaded provides a stress concentration and a risk of mechanical failure

NOTE 1 This could be, for example, a grain boundary, large grain, pore, impurity or crack.

NOTE 2 The term flaw should not be taken as meaning the material is functionally defective, but rather as containing an inevitable microstructural inhomogeneity.

3.1.2
critical flaw
flaw acting as the source of failure