Advanced Technical Ceramics - Monolithic ceramics - Part 2: Oxidation test

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NATIONAL FOREWORD

Käesolev Eesti standard EVS-ENV 12923-2:2010 sisaldab Euroopa standardi ENV 12923-2:2001 ingliskeelset teksti.	This Estonian standard EVS-ENV 12923-2:2010 consists of the English text of the European standard ENV 12923-2:2001.
Standard on kinnitatud Eesti Standardikeskuse 30.09.2010 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas.	This standard is ratified with the order of Estonian Centre for Standardisation dated 30.09.2010 and is endorsed with the notification published in the official bulletin of the Estonian national standardisation organisation.
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Advanced technical ceramics - Monolithic ceramics - Part 2: Oxidation test

Céramiques techniques avancées - Céramiques monolithiques - Partie 2: Détermination de l'oxidation

Hochleistungskeramik - Monolithische Keramik - Teil 2: Oxidationsprüfung

This European Prestandard (ENV) was approved by CEN on 4 June 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.

CEN members are required to announce the existence of this ENV in the same way as for an EN and to make the ENV available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the ENV) until the final decision about the possible conversion of the ENV into an EN is reached.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Foreword

This European Prestandard has been prepared by Technical Committee CEN/TC 184 "Advanced technical ceramics", the secretariat of which is held by BSI.

EN 12923 consists of two parts:

Part 1: *General practice for undertaking corrosion tests (ENV)*

Part 2: *Oxidation test (ENV)*

Annex A is informative.

This Prestandard includes a Bibliography.

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, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 SCOPE

This Part of ENV 12923 describes a simple oxidation test for advanced technical ceramics. The test is designed to give an assessment of the mass and dimensional changes of test pieces following oxidation at high temperature in an oxidizing atmosphere, and to assess whether oxidation has a significant effect on the subsequent strength, either at room temperature or at elevated temperatures.

NOTE 1 This test method does not allow definition of other mechanical performance changes resulting from high-temperature exposure, such as changes in susceptibility to subcritical crack growth, creep behaviour, migration of secondary constituents, etc.

NOTE 2 This test method does not cover the additional effects of other corrodents in the ambient atmosphere, such as salt vapours, reducing or corrosive gases, and other contaminants. This method also does not cover tests at pressures other than ambient atmospheric pressure.

NOTE 3 An interlaboratory evaluation of the procedure given in this standard is summarised in annex A.

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 (including amendments).

ENV 820-1 *Advanced technical ceramics –Monolithic ceramics –Thermomechanical properties – Part 1: Determination of flexural strength at elevated temperature.*

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

ENV 1006 *Advanced technical ceramics – Methods of testing monolithic ceramics – Guidance on the sampling and selection of test pieces.*

EN 60584-1 *Thermocouples – Part 1: Reference tables (IEC 60584-1:1995).*

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

EN ISO/IEC 17025 *General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025:1999).*

ISO 3611 *Micrometer callipers for external measurement.*

ISO 4677-1 *Atmospheres for conditioning and testing – Determination of relative humidity – Part 1: Aspirated psychrometer method.*

ISO 4677-2 *Atmospheres for conditioning and testing – Determination of relative humidity – Part 2: Whirling psychrometer method.*

ISO 6906 *Vernier callipers reading to 0.02 mm.*

3 TERMS AND DEFINITIONS

For the purposes of this European Prestandard the following terms and definitions apply.

3.1
oxidation
process of reaction of a ceramic material with oxygen in the surrounding atmosphere, including any internal reactions as a result of the presence of open porosity or of diffusion of ions to or from the ceramic surface

3.2
catastrophic oxidation
oxidation of a ceramic material which, under prescribed conditions leads to rapid material destruction as a result of lack of development of protective surface layers, skins or scales

4 BACKGROUND

Non-oxide ceramic materials, such as those based on silicon nitride, silicon carbide, titanium diboride and boron nitride, are subject to chemical change when exposed to oxygen in ambient atmospheres at high temperatures. The changes are generally the substitution of the non-oxygen nonmetallic species by oxygen, which results in a mass change and the development of a surface skin of altered composition. In addition, the chemical potentials involved can cause migration of both metallic and nonmetallic species within the near surface layer, altering the microstructure of the material. In the case of materials with open porosity, such as reaction-bonded silicon nitride and some silicon carbides, oxidation will generally occur through continuous pores which are initially surface connected, although these may become blocked as oxidation proceeds. There may be a consequent gradient of the extent of oxidation through the thickness of a sample or component.

The extent of oxidation is controlled by the chemical nature of the material, its homogeneity and the distribution of any adventitious impurities. Local concentrations of impurities or pores intersected by the surface of the test piece, for example, may lead to locally enhanced oxidation and the formation of oxidation pits.

The nature of the external surface of the test piece will change. In some cases a glazed appearance may result if the oxidation products are glassy in character, such as in the case of some silicon nitrides and silicon carbides. In others where the surface layer becomes substantially crystalline, it may be matt in appearance. Such layers may be protective of further oxidation, or substantially slow the process down if they remain intact. However, in some cases, the oxidation product may not adhere to the sample, but tend to flake off as a result of disruptive forces caused by volume changes, phase changes and/or thermal