

**Advanced technical ceramics - Monolithic ceramics -
General and textural properties - Part 5: Determination
of phase volume fraction by evaluation of micrographs**

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN 623-5:2009 sisaldab Euroopa standardi EN 623-5:2009 ingliskeelset teksti.

Standard on kinnitatud Eesti Standardikeskuse 30.09.2009 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas.

Euroopa standardimisorganisatsioonide poolt rahvuslikele liikmetele Euroopa standardi teksti kättesaadavaks tegemise kuupäev on 15.07.2009.

Standard on kättesaadav Eesti standardiorganisatsioonist.

This Estonian standard EVS-EN 623-5:2009 consists of the English text of the European standard EN 623-5:2009.

This standard is ratified with the order of Estonian Centre for Standardisation dated 30.09.2009 and is endorsed with the notification published in the official bulletin of the Estonian national standardisation organisation.

Date of Availability of the European standard text 15.07.2009.

The standard is available from Estonian standardisation organisation.

ICS 81.060.30

Standardite reprodutseerimis- ja levitamiseõigus kuulub Eesti Standardikeskusele

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English Version

**Advanced technical ceramics - Monolithic ceramics - General
and textural properties - Part 5: Determination of phase volume
fraction by evaluation of micrographs**

Céramiques techniques avancées - Céramiques
monolithiques - Propriétés générales et textures - Partie 5:
Détermination de la fraction volumique de phase par
évaluation des microphotographies

Hochleistungskeramik - Monolithische Keramik -
Allgemeine und strukturelle Eigenschaften - Teil 5:
Bestimmung des Volumenanteils von Phasen durch
Auswertung von Mikrogefügeaufnahmen

This European Standard was approved by CEN on 19 June 2009.

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Foreword

This document (EN 623-5:2009) 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of an identical text or by endorsement, at the latest by January 2010, and conflicting national standards shall be withdrawn at the latest by January 2010.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 ENV 623-5:2002.

EN 623 consists of five parts, under the general title "Advanced technical ceramics - Monolithic ceramics - General and textural properties":

- Part 1: *Determination of the presence of defects by dye penetration*
- Part 2: *Determination of density and porosity*
- Part 3: *Determination of grain size and size distribution (characterized by the Linear Intercept Method)*
- Part 4: *Determination of surface roughness*
- Part 5: *Determination of phase volume fraction by evaluation of micrographs*

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1 Scope

This part of EN 623 specifies a manual method of making measurements for the determination of volume fraction of major phases in advanced technical ceramics using micrographs of polished and etched sections, overlaying a square grid of lines, and counting the number of intersections lying over each phase.

NOTE 1 This method assumes that the true phase volume fractions are equivalent to area fractions on a randomly cut cross-section according to stereological principles.

NOTE 2 Guidelines for polishing and etching of advanced technical ceramics can be found in Annexes A and B.

The method applies to ceramics with one or more distinct secondary phases, such as found in $\text{Al}_2\text{O}_3/\text{ZrO}_2$, Si/SiC , or $\text{Al}_2\text{O}_3/\text{SiC}_w$.

If the test material contains discrete pores, these can be treated as a secondary phase for the purpose of this method provided that there is no evidence of grain pluck-out during polishing being confused with genuine pores.

NOTE 3 If the material contains more than about 20 % porosity there is a strong risk that the microstructure will be damaged during the polishing process, and measurement of volume fraction of pores may become misleading.

Secondary phase volume fractions or porosity present at levels of less than 0,05 are subject to considerable error and potential scatter in results. A larger number of micrographs than the minimum of three is normally needed to improve the consistency and accuracy of the results.

NOTE 4 Many ceramics contain small amounts of secondary glassy phases. In order to make a reasonable estimate of glassy phase content, the glass material between crystalline grains should be readily observable, and thus should be at least 0,5 μm in width. The method in this European Standard is not considered appropriate for narrow glassy films around grains.

This method assumes that the selected regions of a prepared cross-section are statistically representative of the whole sampled section.

NOTE 5 Microstructures are seldom homogeneous, and the phase contents can vary from micrograph to micrograph. It is essential to survey a sufficiently wide area of the prepared section to ensure that those areas selected for evaluation are representative, and do not contain eye-catching irregularities.

Some users of this European Standard can wish to apply automatic or semiautomatic image analysis to micrographs or directly captured microstructural images. This is currently outside the scope of this European Standard, but some guidelines are given in Annex C.

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 1006, *Advanced technical ceramics - Monolithic ceramics - Guidance on the selection of test pieces for the evaluation of properties*

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