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ADVANCED TECHNICAL CERAMICS - METHODS OF TEST FOR CERAMIC COATINGS - PART 1: DETERMINATION OF COATING THICKNESS BY CONTACT PROBE FILOMETER

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Advanced technical ceramics - Methods of test for ceramic coatings - Part 1: Determination of coating thickness by contact probe filometer

Céramiques techniques avancées - Méthodes d'essai pour revêtements céramiques - Partie 1: Détermination de l'épaisseur du revêtement par profilomètre à contact

Hochleistungskeramik - Verfahren zur Prüfung keramischer Schichten - Teil 1: Bestimmung der Schichtdicke mit einem Kontaktprofilometer

This European Standard was approved by CEN on 28 November 2002.

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 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 Management Centre has the same status as the official versions.

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Contents

Foreword

This document (EN 1071-1:2003) 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of an identical text or by endorsement, at the latest by September 2003, and conflicting national standards shall be withdrawn at the latest by September 2003.

This document supersedes ENV 1071-1:1993.

EN 1071 '*Advanced technical ceramics – Methods of test for ceramic coatings*' consists of 10 parts:

Part 1: Determination of coating thickness by contact probe profilometer

Part 2: Determination of coating thickness by the crater grinding method

Part 3: Determination of adhesion and other mechanical failure modes by a scratch test

Part 4: Determination of chemical composition

Part 5: Determination of porosity

Part 6: Determination of the abrasion resistance of coatings by a micro-abrasion wear test

Part 7: Determination of hardness and Young's modulus by instrumented indentation testing

Part 8: Rockwell indentation test for evaluation of adhesion

Part 9: Determination of fracture strain

Part 10: Determination of coating thickness by cross sectioning

Annex A is informative.

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

1 Scope

This part of this European Standard specifies a method for the determination of the thickness of ceramic coatings by measurement of the step height using a contact probe profilometer.

NOTE An alternative measurement of thickness, using a crater grinding method, is specified in ENV 1071-2.

2 Normative references

This European Standard 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 Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN ISO 3274 *Geometrical product specifications (GPS) - Surface texture: Profile method - Nominal characteristics of contact (stylus) instruments (ISO 3274:1996).*

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

3 Principle

The coating thickness often plays a major role in the performance of coated tools and machine parts. Many different techniques have been developed for assessing the coating thickness. Among these, the step height measurement is a very convenient technique because of its ease, wide applicability and accuracy.

In order to create a step, part of the substrate shall remain uncoated. This can be done by covering part of the substrate during deposition, e. g. by means of a covering plate or tape or by scratching the coating substrate/-system until delamination of the coating occurs (see, for example, ENV 1071-3).

The thickness of the coating is then determined by scanning this step beneath the contact stylus of a contact probe profilometer (see Figure 1).

NOTE 1 When covering part of the substrate during deposition, it can happen that the deposition rate near the step is influenced by the covering medium. This results in a step which is not representative for the coating thickness. This can be prevented by using very thin covering plates, or it can be circumvented by etching away part of the coating after the coating process.

NOTE 2 In the case of line-of-sight processes (such as ion beam deposition methods), shadowing effects are to be avoided, in order to create a representative step.

4 Apparatus

The contact probe profilometer shall be in accordance with EN ISO 3274.

The stylus tip consists of a diamond and its tip radius may be 2 µm, 5 µm or 10 µm. The instrument shall be calibrated by using step height calibration standards in accordance with the limits given in clause 7.

NOTE 1 It is important to ensure that the profilometer tip is not damaged.

NOTE 2 In metrology, it is always very important to have calibration and checking conditions corresponding to the measurement conditions. Therefore, the calibration or check standards should be as similar as possible to the step height to be measured.