

**Advanced technical ceramics - Methods of test for
ceramic coatings - Part 12: Reciprocating wear test**

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NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN 1071-12:2010 sisaldab Euroopa standardi EN 1071-12:2010 ingliskeelset teksti.

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English Version

**Advanced technical ceramics - Methods of test for ceramic
coatings - Part 12: Reciprocating wear test**

Céramiques techniques avancées - Méthodes d'essai pour
revêtements céramiques - Partie 12 : Essai d'usure en va-
et-vient

Hochleistungskeramik - Verfahren zur Prüfung keramischer
Schichten - Teil 12: Schwingungs-Verschleißprüfung

This European Standard was approved by CEN on 30 January 2010.

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Foreword

This document (EN 1071-12:2010) 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of an identical text or by endorsement, at the latest by September 2010, and conflicting national standards shall be withdrawn at the latest by September 2010.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.

EN 1071, *Advanced technical ceramics — Methods of test for ceramic coatings*, consists of the following 13 parts:

- *Part 1: Determination of coating thickness by contact probe filometer*
- *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 by electron probe microanalysis (EPMA)*
- *Part 5: Determination of porosity (withdrawn)*
- *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- *Part 7: Determination of hardness and Young's modulus by instrumented indentation (withdrawn)*
- *Part 8: Rockwell indentation test for evaluation of adhesion*
- *Part 9: Determination of fracture strain*
- *Part 10: Determination of coating thickness by cross sectioning*
- *Part 11: Determination of internal stress by the Stoney formula*
- *Part 12: Reciprocating wear test*
- *Part 13: Determination of wear rate by the pin-on-disk method*

Parts 8 and 11 are Technical Specifications. CEN/TS 1071-7:2003 was withdrawn on publication of EN ISO 14577-4:2007.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, 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 the United Kingdom.

Introduction

Proper evaluation of the wear performance of ceramic coatings is essential to understanding their behaviour and to increasing their use in applications where high performance and predictable life are critical requirements, for example in the aerospace, automotive and biomedical industries. This part of EN 1071 describes a technique for the determination of the wear behaviour of a ceramic coating by reciprocating, under load, a flat or spherically ended pin against a flat plate. Depending on the information required, either the plate or pin or both may be coated with the material under test, with the other member of the couple being selected for its relevance to the system under evaluation. Wear is determined by weight loss, by profilometry, by linear measurement or by a combination of these. Coatings may be tested under dry or lubricated conditions. Where suitable instrumentation is available, the test can provide important information about the friction generated in the system. In addition to providing data on the frictional interaction in the system per se, monitoring of the friction can, by detecting changes in the level or trend of the friction force, provide important information about changes occurring during the test, e.g. removal or fracture of the coating, changes in wear mechanisms, etc. The test for use with bulk materials reciprocating under non-lubricated conditions is well described in [1].

The standard identifies the basic equipment requirements and the test critical parameters for testing ceramic coatings, and provides for appropriate operating procedures and measurement protocols to ensure their proper control. In addition, it provides for consistency in the analysis of data and in the treatment of errors.

This part of EN 1071 complements parts 6 [2] and 13 [3], which describe techniques for micro-scale abrasion wear testing and pin-on-disc wear testing of ceramic coatings respectively.

1 Scope

1.1 This European Standard describes a method for evaluating the wear of ceramic coatings by use of a reciprocating wear test whereby a flat or spherically ended pin is reciprocated, under load, against a flat plate. Depending on the conditions being simulated, either the pin or plate or both may be coated with the material under test, with the other member of the couple being selected for its relevance to the system under evaluation. The method described is considered to be not suitable for evaluating fretting wear.

1.2 The method is intended for evaluating coatings with a thickness of more than 1 µm, though might also be used for testing thinner coatings.

1.3 The test may be carried out under either dry or lubricated conditions. However, the test is not designed for evaluating the properties of lubricants except insofar as they affect the wear behaviour of the materials being tested. Related methods for testing lubricants using reciprocating motion are given in references [4] – [6].

1.4 Testing a materials couple under a range of loading conditions might provide information about the adhesive and/or cohesive strength of the coating, in addition to its wear behaviour.

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 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 following terms and definitions apply.

3.1

wear track

line of contact of pin on plate during reciprocation

3.2

wear scar

worn region on the test specimen

3.3

volume wear rate

volume wear coefficient

specific wear rate

volume of material removed from a surface in a sliding distance of 1 m under a normal load of 1 N

3.4

mass wear rate

mass wear coefficient

mass of material removed from a surface in a sliding distance of 1 m under a normal load of 1 N