

Fine ceramics (advanced ceramics, advanced technical ceramics) — Determination of the abrasion resistance of coatings by a micro- scale abrasion test (ISO 26424:2008)

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National foreword

This British Standard is the UK implementation of EN ISO 26424:2016. It is identical to ISO 26424:2008. It supersedes BS EN 1071-6:2007 and BS ISO 26424:2008 which are withdrawn.

The UK participation in its preparation was entrusted to Technical Committee RPI/13, Advanced technical ceramics.

A list of organizations represented on this committee can be obtained on request to its secretary.

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English Version

Fine ceramics (advanced ceramics, advanced technical ceramics) - Determination of the abrasion resistance of coatings by a micro-scale abrasion test (ISO 26424:2008)

Céramiques techniques - Détermination de la résistance à l'abrasion des revêtements par essai d'abrasion à micro-échelle (ISO 26424:2008)

Hochleistungskeramik - Bestimmung der Beständigkeit gegen Abrieb von Schichten durch eine Mikroabriebprüfung (ISO 26424:2008)

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European foreword

The text of ISO 26424:2008 has been prepared by Technical Committee ISO/TC 206 “Fine ceramics” of the International Organization for Standardization (ISO) and has been taken over as EN ISO 26424:2016 by Technical Committee CEN/TC 184 “Advanced technical ceramics” the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by October 2016, and conflicting national standards shall be withdrawn at the latest by October 2016.

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 EN 1071-6:2007.

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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

The text of ISO 26424:2008 has been approved by CEN as EN ISO 26424:2016 without any modification.

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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ISO 26424 was prepared by Technical Committee ISO/TC 206, *Fine ceramics*.

Fine ceramics (advanced ceramics, advanced technical ceramics) — Determination of the abrasion resistance of coatings by a micro-scale abrasion test

1 Scope

This International Standard specifies a method for measuring the abrasive wear rate of ceramic coatings by means of a micro-scale abrasion wear test based on the well-known crater-grinding technique used for coating thickness determination in ISO 26423^[1].

The method can provide data on both coating and substrate wear rates, either by performing two separate tests or by careful analysis of the data from a single test series.

The method can be applied to samples with planar or non-planar surfaces, but the results analysis described in Clause 9 applies only to flat samples. For non-planar samples, a more complicated analysis, possibly requiring the use of numerical methods, is required.

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.

ISO 3290-1, *Rolling bearings — Balls — Part 1: Steel balls*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

abrasive wear rate

abrasive wear coefficient

K

volume of material removed in unit sliding distance under a normal contact load of 1 N

4 Significance and use

Although few protective coatings are subject to single wear processes, the abrasive wear resistance of such coatings can play a decisive role in their performance. Hence, knowledge of the abrasive wear resistance of ceramic coatings can help in the proper selection of coatings for applications where abrasion plays a major role in their degradation. Although techniques exist to measure the abrasive wear behaviour of bulk materials and thick films (see References [1] to [3]), these techniques are not easily applied to thin films and the results are difficult to interpret when the methods are used on curved surfaces.

The purpose of this International Standard is to provide a method for measuring the abrasion resistance of both thin and thick coatings and of bulk materials. The test can be carried out on flat surfaces or surfaces with a known radius of curvature and requires test pieces measuring only a few square millimetres. However, the calculations described in Clause 9 apply only to flat test pieces and are applicable only to homogeneous single-layer coatings. Errors may occur if the test is used on inhomogeneous coatings. References [4] and [5] give details of analytical treatments for determining the wear rate of coatings on curved surfaces.

By proper treatment of the results as indicated in 9.2, where the test produces penetration of the coating, it can provide abrasive wear coefficients for both the coating and the substrate from a single test series.

Although the test is designed to allow quantitative measurement of abrasive wear coefficients, it can be adapted as a quality control test for use on real components.

5 Principle

In the test, a ball is rotated whilst being pressed against the test piece, and an abrasive slurry is fed into the contact zone. A spherical depression is produced, and the size of this depression is measured. Where perforation of the coating does not occur, the wear rate of the coating can be obtained from a single crater. When perforation of the coating occurs, the wear rate of both the coating and the substrate can be calculated by making a series of such craters and measuring their dimensions.

6 Apparatus and materials

6.1 Test system

A ball which can be rotated and pressed against the coated test piece shall be used. Two variants of the ball system are shown in Figure 1, where either the test piece, mounted on a deadweight-loaded lever, is pressed against a directly driven ball or the ball's own weight presses it against the test piece.

NOTE It has been found ^[6] that the results obtained with free-ball systems [see Figure 1 a)] can vary depending on the precise system geometry. In particular, it has been found that the tilt angle of the test piece holder and the width of the groove in the drive shaft that supports the ball can have an important influence on the results. A tilt angle of 60° to 75° and a shaft groove width of 10 mm have been found to result in the smallest variability under typical conditions.

The test system shall be constructed so that the rotational speed of the ball remains constant throughout any test and is reproducible to better than $\pm 10\%$ of the nominal value between tests. The drive shaft shall have a total run-out of less than 20 μm at the points of contact with the ball.

6.2 Test balls

The balls used are typically 25-mm-diameter hardened steel, e.g. UNS G52986 (SAE 52100) and shall, prior to any conditioning, conform to the requirements of ISO 3290-1.

NOTE 1 Balls can be used in a polished condition, but it has been found ^[7] that the test behaviour is erratic and poor results are obtained if balls are used without conditioning.

The recommended conditioning treatment consists of running the new test ball for at least 300 revolutions on a non-critical part of the test piece, or another suitable surface, under normal test conditions and repeating this for at least five different orientations of the ball before starting the test programme.

NOTE 2 A flat, ground steel coupon with a hardness of between 200 HV30 and 800 HV30 has been found to be suitable for conditioning the ball.

NOTE 3 Following conditioning, balls have been found to be usable for around 50 individual craters, depending on the precise conditions used.