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Fine ceramics (advanced ceramics, advanced technical ceramics) — Methods for evaluating wear and friction characteristics of fine ceramic thin films under dry and humid conditions

Céramiques techniques — Méthodes pour l'évaluation des caractéristiques d'usure et de frottement des films minces de céramiques techniques en conditions sèches et humides

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Contents

Page

Foreword ..... **v**
Introduction ..... **vi**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
4 Test specimens **2**
5 Measurement principle **2**
6 Testing room environment **2**
7 Wear formation test apparatus **3**
8 Test specimen preparation **5**
9 Test specimen pretreatment **5**
9.1 General 5
9.2 Test specimen cleaning 5
9.3 Test specimen drying 5
10 Environmental conditions for the formation of the wear and the evaluation of friction coefficient **6**
10.1 General 6
10.2 Dry environment 6
10.3 High-humidity environment 6
11 Wear motion conditions **6**
11.1 Reciprocating wear conditions 6
11.2 Rotating disc wear conditions 7
12 Evaluation of wear track cross-section formed on thin film test specimen surface **8**
13 Evaluation of volume of worn portion on indenter ball surface **8**
13.1 General 8
13.2 Observation of indenter ball wear surface profile 8
13.3 Calculation of volume of worn portion on indenter ball surface 9
14 Investigations of morphology and elemental distribution maps for wear tracks on thin film test specimens and worn sections on indenter balls **9**
14.1 General 9
14.2 Observation of the morphology 9
14.3 Investigations of elemental distribution maps 10
15 Calculation of friction coefficient **10**
16 Testing procedures **10**
16.1 Measurement of thickness of thin film test specimen 10
16.2 Thin film test specimen preparation and cleaning 10
16.3 Setting of wear formation conditions 10
16.3.1 General 10
16.3.2 Wear formation conditions for a dry environment 11
16.3.3 Wear formation conditions for a high-humidity environment 11
16.4 Wear formation 11
16.4.1 Start of wear formation on the thin film test specimen 11
16.4.2 Friction force measurement 11
16.5 Evaluation of thin film test specimen surface and indenter ball surface after wear formation 11
16.5.1 General 11
16.5.2 Measurement of wear track cross-section on thin film test specimen 11

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16.5.3 Evaluation of volume of worn portion on indenter ball surface ... 11
16.5.4 Investigations of morphology and elemental distribution maps ... 11
16.6 Calculation of friction coefficient ... 11

17 Precautions for summarization of test results ... 12

18 Test report ... 12

Annex A (informative) **Example of reciprocating slide wear results and rotating slide wear results ... 13**

Annex B (informative) **Method of holding polymer film or thin glass plate with a thickness of < 200 µm in sliding wear formations ... 15**

Annex C (informative) **Effects of combining thin film materials and indenter materials in sliding wear tests ... 17**

Annex D (informative) **Investigation of optimal load for indenter ... 22**

Annex E (informative) **Quantification of wear track cross-section area ... 24**

Annex F (informative) **Examples of investigations of morphology and elemental distribution maps for wear tracks on thin films and worn sections of indenter balls ... 25**

Bibliography ... 30

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

Fine ceramic thin films are used in a wide variety of applications, such as sensors, actuators or other micromechanical elements; display elements; memory elements; recording media; optical elements; packaging films; and films and glass for building construction and vehicles. In the industrial application of fine ceramic thin films, resistance to wear is an important index for evaluation. The resistance to wear of fine ceramic thin films is greatly affected by environmental humidity and the humidity history of the thin film. Fine ceramic thin films are also used in different humidity environments, necessitating standards for the evaluation of wear resistance and the friction coefficient under a wide humidity range. Standards published to date concerning wear resistance testing assume only a temperature environment of 23 °C and a relative humidity of 50 %; the thickness of the thin films subject to evaluation is also comparatively large, at several to 10 µm. These testing procedures are inappropriate for evaluating the wear resistance of fine ceramic thin films that have a thickness of up to approximately 1 µm and are applied for electronic and optical devices, because the wear resistance for a smaller indentation load is affected by the relative humidity of the test environment, i.e. the mechanisms employed in the wear test for fine ceramic thin films with a smaller indentation load are strongly affected by the relative humidity of the test environment. Therefore, the wear test for fine ceramic thin films should be performed under a regulated relative humidity condition. This document provides measurement methods that facilitate the accurate evaluation of wear resistance for fine ceramic thin films in dry and high-humidity environments, where such films have a thickness of up to approximately 1 µm and are deposited on a thin substrate or an organic polymer film base. This document has been enacted to facilitate industrial development through the prompt dissemination of these measurement methods.

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Fine ceramics (advanced ceramics, advanced technical ceramics) — Methods for evaluating wear and friction characteristics of fine ceramic thin films under dry and humid conditions

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1 Scope

This document specifies a method for testing the wear resistance and friction coefficient for fine ceramic thin films in dry and high-humidity environments, where such films have a thickness of up to approximately 1 µm and are deposited on a substrate or a base, including a thin substrate or a very thin organic polymer film base.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 3274, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Nominal characteristics of contact (stylus) instruments*

ISO 13565-1, *Geometrical Product Specifications (GPS) — Surface texture: Profile method; Surfaces having stratified functional properties — Part 1: Filtering and general measurement conditions*

ISO 13565-2, *Geometrical Product Specifications (GPS) — Surface texture: Profile method; Surfaces having stratified functional properties — Part 2: Height characterization using the linear material ratio curve*

ISO 20507, *Fine ceramics (advanced ceramics, advanced technical ceramics) — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 20507 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
wear
phenomenon leading to progressive loss or progressive displacement from the surface of a solid material due to motion relative to a contacting body

3.2
frictional force
resistive force exerted on an opposing body when bodies in contact move or tend to slide against each other

3.3
friction coefficient
dimensionless ratio of frictional force to the normal force applied

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