International Standard

ISO 19606

Fine ceramics (advanced ceramics, advanced technical ceramics) — Test method for surface roughness of fine ceramic films by atomic force microscopy

Céramiques techniques — Méthode d'essai pour la rugosité de surface des films céramique fins par microscopie à force atomique

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Foreword

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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*.

This second edition cancels and replaces the first edition (ISO 19606:2017), which has been technically revised.

The main changes are as follows:

— in Clause 3, ISO 4287 and ISO 4288 have been replaced with ISO 21920-1–3;

— revision of 6.2 and Clause 3;

— symbols have been revised throughout by moving text to subscript;

— Annex A changed from normative to informative.

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Introduction

Surface roughness measurements of fine ceramic thin films at the nanometre scale by atomic force microscopy is widely applied to quality control and assurance in industries.

One frequently occurring issue in roughness measurements by atomic force microscopy resulting from its scale dependency is the deviation of roughness due to wear of the probe tip or the deviation in the curvature of commercially available probe tips. This makes it difficult to obtain a reliable and reproducible result of the roughness measurement. Therefore, it is highly desirable to standardize a method to evaluate probe tip diameter or curvature radius.

This document covers the evaluation of probe-tip diameter and provides a method to judge the adequateness of a probe tip for use in day-to-day roughness measurements of fine ceramic thin films with a certain arithmetical mean roughness in the range needing the use of atomic force microscopy in production lines or quality assurance processes.

It should be noted that because surface roughness is a scale-dependent metrology parameter, it is unavoidable that the probe-tip evaluation process contains some contradictory procedures, namely the adequateness of the probe tip for a roughness measurement depends on unmeasurable true roughness in a scale of interest.

In this document, the parameters based on roughness profiles are used. The roughness profile is obtained by using a low-pass filter according to ISO 16610-21. The process to obtain the sampling length, which is identical to cut-off wavelength, is given in ISO 21920-2. Some different sampling lengths to process a primary profile can be applied to obtain appropriate values of arithmetic mean deviation of a roughness profile, if necessary.

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Fine ceramics (advanced ceramics, advanced technical ceramics) — Test method for surface roughness of fine ceramic films by atomic force microscopy

1 Scope

This document specifies a method to evaluate the adequateness of a probe tip for fine-ceramic thin-film surface roughness measurements by atomic force microscopy. This method applies to surfaces with an arithmetical mean roughness, R_a, in the range of about 1 nm to 30 nm and a mean width of roughness profile elements, R_{sm}, in the range of about 0,04 µm to 2,5 µm.

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 11039, *Surface chemical analysis — Scanning-probe microscopy — Measurement of drift rate*

ISO 11952, *Surface chemical analysis — Scanning-probe microscopy — Determination of geometric quantities using SPM: Calibration of measuring systems*

ISO 18115-2, *Surface chemical analysis — Vocabulary — Part 2: Terms used in scanning-probe microscopy*

ISO 21920-1, *Geometrical product specifications (GPS) — Surface texture: Profile — Part 1: Indication of surface texture*

ISO 21920-2, *Geometrical product specifications (GPS) — Surface texture: Profile — Part 2: Terms, definitions and surface texture parameters*

ISO 21920-3, *Geometrical product specifications (GPS) — Surface texture: Profile — Part 3: Specification operators*

ISO 25178-2, *Geometrical product specifications (GPS) — Surface texture: Areal — Part 2: Terms, definitions and surface texture parameters*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 21920-1, ISO 21920-2, ISO 21920-3, ISO 18115-2, ISO 11039, ISO 11952 and ISO 25178-2 and the following apply.

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

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

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

3.1
evaluation length
$l_e(X)$, $l_e(Y)$
length of surface profile in the *X* or *Y* direction

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