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Surface chemical analysis — Sputter depth profiling — Optimization using layered systems as reference materials

Analyse chimique des surfaces — Profilage d'épaisseur par bombardement — Optimisation à l'aide de systèmes mono- ou multicouches comme matériaux de référence

Reference number
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Contents

Page

Foreword ... **iv**
Introduction ... **v**
1 Scope ... **1**
2 Normative references ... **1**
3 Terms and definitions ... **1**
4 Symbols and abbreviated terms ... **1**
5 Setting parameters for sputter depth profiling ... **2**
5.1 General ... 2
5.2 Auger electron spectroscopy ... 3
5.3 X-ray photoelectron spectroscopy ... 3
5.4 Secondary ion mass spectrometry ... 4
6 Depth resolution at an ideally sharp interface in sputter depth profiles ... **4**
6.1 Measurement of depth resolution ... 4
6.2 Average sputtering rate $\overline{z}_{\mathrm{av}}$ ... 4
6.3 Depth resolution Δz ... 5
7 Procedures for optimization of parameter settings ... **5**
7.1 Alignment of sputtered area with a smaller analysis area ... 5
7.1.1 General ... 5
7.1.2 AES ... 7
7.1.3 XPS with a small probe (e.g. monochromator) ... 7
7.1.4 XPS with a large area source (e.g. without monochromator) ... 7
7.1.5 SIMS ... 7
7.2 Optimization of parameter settings ... 8
Annex A (informative) **Factors influencing the depth resolution** ... **9**
Annex B (informative) **Typical single-layered systems as reference materials** ... **12**
Annex C (informative) **Typical multilayered systems used as reference materials** ... **13**
Annex D (informative) **Uses of multilayered systems** ... **14**
Bibliography ... **15**

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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 201, *Surface chemical analysis*, Subcommittee SC 4, *Depth profiling*.

This third edition cancels and replaces the second edition (ISO 14606:2015), which has been technically revised.

The main changes are as follows:

— Clause 3: terms and definitions have been simplified using normative references;

— 6.2: descriptions have been added that it is only necessary to sputter off a few certain periods of layers from the topmost surface to obtain average sputtering rate for practical use of a multi-layered system;

— 7.1.3, 7.1.4 and 7.1.5: descriptions have been added to mention the use of the procedures provided by manufacturer of apparatuses for alignment of sputtered area with a smaller analysis area;

— Table B.1 and Table C.1: contents have been updated.

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

Reference materials are useful in optimizing the depth resolution of sputter profiling methods in materials such as silicon wafers, multilayered devices (e.g. AlGaAs double-hetero lasers, high electron mobility transistors) and alloy-galvanized steel for corrosion-resistant car bodies.

The specific applications of this document are as follows.

a) Single-layered and multilayered systems on a substrate as reference materials are useful for the optimization of depth resolution as a function of instrument settings in Auger electron spectroscopy, X-ray photoelectron spectroscopy and secondary ion mass spectrometry.

b) These systems are useful for illustrating the effects of the evenness of the sputter crater, the inclination of the crater bottom, the sample drift, the drift of sputter conditions (e.g. ion beam current density) on depth resolution.

c) These systems are useful for illustrating the effects of sputter-induced surface roughening and sputter-induced atomic mixing on depth resolution.

d) These systems are useful for the evaluation of instrument performance for instrument suppliers and users.

e) This document is timely and topical, and can be used for a basis of future development of sputter depth profiling.

A list of ISO Guides related to this document is given in the Bibliography[1][2][3][4][5].

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Surface chemical analysis — Sputter depth profiling — Optimization using layered systems as reference materials

1 Scope

This document gives guidance and requirements on the optimization of sputter-depth profiling parameters using appropriate single-layered and multilayered reference materials, in order to achieve optimum depth resolution as a function of instrument settings in Auger electron spectroscopy, X-ray photoelectron spectroscopy and secondary ion mass spectrometry.

This document is not intended to cover the use of special multilayered systems such as delta doped layers.

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 18115-1, *Surface chemical analysis — Vocabulary — Part 1: General terms and terms used in spectroscopy*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 18115-1 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
image depth profile
three-dimensional representation of the spatial distribution of a particular elemental or molecular species (as indicated by emitted secondary ions or electrons) as a function of depth or material removed by sputtering

3.2
plateau region
region in which the signal remains constant or without significant variation with sputtering time

3.3
sputter depth profile
depth profile obtained when the surface is measured as material is removed by sputtering

4 Symbols and abbreviated terms

Δz	depth resolution
I	signal intensity

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