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Surface chemical analysis — X-ray photoelectron spectroscopy — Guidelines for analysis

Analyse chimique des surfaces — Spectroscopie de photoélectrons par rayons X — Lignes directrices pour l'analyse

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Foreword

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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 7, *Electron spectroscopies*.

This second edition cancels and replaces the first edition (ISO 10810:2010), which has been technically revised. The main changes to the previous edition are as follows:

— Table 3: semiconductor wafer added as a specimen form;

— 6.2.7: paragraph replaced to reflect modern practice;

— 6.3.10: nanoparticles added as a material type;

— Clause 8 and the flow chart in Figure 6 have been thoroughly revised to improve clarity. The cells in the flow chart now contain references to the appropriate subclause within Clause 8;

— 8.2.1: it is now pointed out that the use of the C 1s peak provides only an approximate binding energy reference;

— 9.3.3.3: mention has been made of the use of ionised clusters of inert gas atoms for depth profiling.

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.

Introduction

X-ray photoelectron spectroscopy (XPS) is used extensively for the surface (1 nm to 10 nm) analysis of materials. Elements in the sample (with the exception of hydrogen and helium) are identified from comparisons of the measured binding energies of their core levels with tabulations of those energies for the different elements. Their chemical states may be determined from shifts in peak positions and other parameters compared with the data for that element in its pure elemental state. Information on the quantities of such elements can be derived from the measured intensities of photoelectron peaks. Calculation of the quantities of the constituent chemical species present in the surface layer studied (outer 1 nm to 10 nm) may then be made using formulae and relative-sensitivity factors provided by the spectrometer manufacturer or locally measured relative-sensitivity factors and appropriate software.

This guidance document is intended to aid the operators of X-ray photoelectron spectrometers in their analysis of the surfaces (outer 1 nm to 10 nm) of typical samples.

Surface chemical analysis — X-ray photoelectron spectroscopy — Guidelines for analysis

1 Scope

This document is intended to aid the operators of X-ray photoelectron spectrometers in their analysis of typical samples. It takes the operator through the analysis from the handling of the sample and the calibration and setting-up of the spectrometer to the acquisition of wide and narrow scans and also gives advice on quantification and on preparation of the final report.

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 apply.

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

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

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

4 Symbols and abbreviations

AES	Auger electron spectroscopy
ARXPS	angle-resolved X-ray photoelectron spectroscopy
CCQM	consultative committee for amount of substance
CRM	certified reference material
EAL	effective attenuation length
FAT	fixed analyser transmission
FRR	fixed retard ratio
FWHM	full width at half maximum
IERF	intensity/energy response function
NIST	National Institute of Standards and Technology
NPL	National Physical Laboratory