

Surface chemical analysis — Auger electron spectroscopy and X-ray photoelectron spectroscopy — Guide to the use of experimentally determined relative sensitivity factors for the quantitative analysis of homogeneous materials

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee CII/60, Surface chemical analysis, which has the responsibility to:

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Summary of pages

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Surface chemical analysis — Auger electron spectroscopy and X-ray photoelectron spectroscopy — Guide to the use of experimentally determined relative sensitivity factors for the quantitative analysis of homogeneous materials

*Analyse chimique des surfaces — Spectroscopie des électrons Auger
et spectroscopie de photoélectrons — Lignes directrices pour
l'utilisation de facteurs expérimentaux de sensibilité relative pour
l'analyse quantitative de matériaux homogènes*



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Foreword

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ISO 18118 was prepared by Technical Committee ISO/TC 201, *Surface chemical analysis*, Subcommittee SC 5, *Auger electron spectroscopy*.

Introduction

Auger electron spectroscopy (AES) and X-ray photoelectron spectroscopy (XPS) are surface-analytical techniques that are sensitive to the composition in the surface region of a material to depths of, typically, a few nanometres (nm). Both techniques yield a surface-weighted signal, averaged over the analysis volume. Most samples have compositional variations, both laterally and with depth, and quantification is often performed with approximate methods since it can be difficult to determine the magnitude of any compositional variations and the distance scale over which they may occur. The simplest sample for analysis is one that is homogeneous. Although this situation occurs infrequently, it is often assumed, for simplicity in the analysis, that the sample material of interest is homogeneous. This International Standard provides guidance on the measurement and use of experimentally determined relative sensitivity factors for the quantitative analysis of homogeneous materials by AES and XPS.

Surface chemical analysis — Auger electron spectroscopy and X-ray photoelectron spectroscopy — Guide to the use of experimentally determined relative sensitivity factors for the quantitative analysis of homogeneous materials

1 Scope

This International Standard gives guidance on the measurement and use of experimentally determined relative sensitivity factors for the quantitative analysis of homogeneous materials by Auger electron spectroscopy and X-ray photoelectron spectroscopy.

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 18115, *Surface chemical analysis — Vocabulary*

ISO 21270, *Surface chemical analysis — X-ray photoelectron and Auger electron spectrometers — Linearity of intensity scale*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 18115 apply. The definitions of absolute elemental sensitivity factor and relative elemental sensitivity factor from ISO 18115 are given for convenience in 3.1 and 3.2. Definitions of average matrix relative sensitivity factor and pure-element relative sensitivity factor from a future amendment to ISO 18115 are given in 3.3 and 3.4.

3.1

absolute elemental sensitivity factor

coefficient for an element with which the measured intensity for that element is divided to yield the atomic concentration or atomic fraction of the element present in the sample

NOTE 1 The choice of use of atomic concentration or atomic fraction should be made clear.

NOTE 2 The type of sensitivity factor used should be appropriate for the equations used in the quantification process and for the type of sample analysed, for example, of homogeneous samples or segregated layers.

NOTE 3 The source of the sensitivity factors should be given in order that the correct matrix factors or other parameters have been used.

NOTE 4 Sensitivity factors depend on parameters of the excitation source, the spectrometer and the orientation of the sample to these parts of the instrument. Sensitivity factors also depend on the matrix being analysed, and in SIMS this has a dominating influence.

3.2

relative elemental sensitivity factor

coefficient proportional to the absolute elemental sensitivity factor, where the constant of proportionality is chosen such that the value for a selected element and transition is unity

NOTE 1 Elements and transitions commonly used are C 1s or F 1s for XPS and Ag M_{4,5}VV for AES.

NOTE 2 The type of sensitivity factor used should be appropriate for the analysis, for example, of homogeneous samples or segregated layers.

NOTE 3 The source of the sensitivity factors should be given in order that the correct matrix factors or other parameters have been used.

NOTE 4 Sensitivity factors depend on parameters of the excitation source, the spectrometer and the orientation of the sample to these parts of the instrument. Sensitivity factors also depend on the matrix being analysed and in SIMS, this has a dominating influence.

3.3

average matrix relative sensitivity factor

coefficient proportional to the intensity calculated for a pure element in an average matrix with which the measured intensity for that element is divided in calculations to yield the atomic concentration or atomic fraction of the element present in the sample

NOTE 1 The choice of use of atomic concentration or atomic fraction should be made clear.

NOTE 2 The type of sensitivity factor used should be appropriate for the equations used in the quantification process and for the type of sample analysed, for example, of homogeneous samples or segregated layers.

NOTE 3 The source of the sensitivity factors should be given. Matrix factors are taken to be unity for average matrix relative sensitivity factors.

NOTE 4 Sensitivity factors depend on parameters of the excitation source, the spectrometer and the orientation of the sample to these parts of the instrument.

3.4

pure-element relative sensitivity factor

coefficient proportional to the intensity measured for a pure sample of an element with which the measured intensity for that element is divided in calculations to yield the atomic concentration or atomic fraction of the element present in the sample

NOTE 1 The choice of use of atomic concentration or atomic fraction should be made clear.

NOTE 2 The type of sensitivity factor used should be appropriate for the equations used in the quantification process and for the type of sample analysed, for example, of homogeneous samples or segregated layers.

NOTE 3 The source of the sensitivity factors should be given in order that the correct matrix factors or other parameters have been used. Matrix factors are significant and should be used with pure-element relative sensitivity factors.

NOTE 4 Sensitivity factors depend on parameters of the excitation source, the spectrometer and the orientation of the sample to these parts of the instrument.

4 Symbols and abbreviated terms

AES	Auger electron spectroscopy
AMRSF	average matrix relative sensitivity factor
ARSF	atomic relative sensitivity factor
ERSF	elemental relative sensitivity factor