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Surface chemical analysis — X-ray photoelectron spectroscopy — Estimating and reporting detection limits for elements in homogeneous materials

Analyse chimique des surfaces — Spectroscopie de photoélectrons par rayons X — Estimation et production de rapports sur les limites de détection des éléments contenus dans les matériaux homogènes



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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 Calculating and reporting detection limits from XPS data	3
5.1 General.....	3
5.2 Required data.....	5
5.3 XPS measurements.....	5
5.3.1 General.....	5
5.3.2 Composition of the sample.....	5
5.3.3 Spectra for detection limit calculation.....	6
5.4 Calculation of background noise.....	7
5.4.1 General.....	7
5.4.2 Standard deviation of intensity from counts.....	7
5.4.3 Standard deviation of intensity from background fit.....	8
5.5 Calculation of the elemental detection limit.....	9
5.5.1 Calculation of the minimal detectable summed intensity.....	9
5.5.2 Calculation of the XPS detection limit.....	9
5.6 Reporting the elemental detection limit.....	10
Annex A (informative) Uncertainties associated with XPS detection limits	11
Annex B (informative) Definition of XPS detection limits	15
Annex C (informative) Examples	16
Annex D (informative) Detection limit conversions	22
Bibliography	24

Foreword

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This document was prepared by Technical Committee ISO/TC 201, *Surface chemical analysis*, Subcommittee SC 7, *Electron spectroscopies*.

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Introduction

X-ray photoelectron spectroscopy (XPS) is a technique widely employed to measure the chemical composition of material surfaces. In many applications, it is used to either confirm or deny the presence of an elemental species at a surface. In either case, it is important to understand the minimal concentration of the element that can be detected by XPS under the measurement conditions either to provide an assessment of confidence in a result or to understand how the measurement conditions should be changed to achieve the required detection limit.

This document provides a straightforward approach to calculating detection limits in X-ray photoelectron spectroscopy from experimental data in common analytical situations. It also provides informative annexes which allow the uncertainty in the calculated detection limit to be determined (see [Annex A](#)) and describe how the XPS detection limit is defined (see [Annex B](#)). Example data and calculations are provided in [Annex C](#). [Annex D](#) contains useful conversions and references which describe how detection limits may be estimated for an X-ray photoelectron spectrometer in the absence of any data except that from a reference material such as clean silver.

These calculations are of critical importance because the technique is routinely used to measure the concentration of elements, which are present in low concentrations at a material surface, and knowledge of the limit of detection provides a statement of confidence when no element can be detected. Furthermore, if a particular detection limit is required, it permits the analyst to calculate the acquisition time required to achieve the specified limit of detection.