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Surface chemical analysis — Electron spectroscopies — Procedures for identifying, estimating and correcting for unintended degradation by X-rays in a material undergoing analysis by X-ray photoelectron spectroscopy

Analyse chimique des surfaces — Spectroscopie d'électrons — Procédures pour l'identification, l'estimation et la correction de la dégradation involontaire par rayons X pendant une analyse de matériau par spectroscopie de photoélectrons par rayons X

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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 on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information.

The committee responsible for this document is ISO/TC 201, *Surface chemical analysis*, Subcommittee SC 7, *Electron spectroscopies*.

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Introduction

The basis of X-ray photoelectron spectroscopy is irradiation of a sample surface by soft X-rays and examination of the excited emission in the form of photo-electrons and Auger electrons. In its most widely used mode, the X-ray flux is of low intensity and spread over a large area. Thus, the technique is generally regarded as one of the least destructive of the available "beam" techniques used for the surface chemical analysis of materials. However, since the time of its inception as a technique for surface analysis, there have been reports of changes in composition arising during the course of analysis.[1]-[4] These reports indicated that, for some materials, a form of degradation during analysis needs to be taken into account and, where possible, a correction made. This International Standard addresses these issues and describes a method by which the extent of degradation can be estimated and a suitable correction obtained.

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Surface chemical analysis — Electron spectroscopies — Procedures for identifying, estimating and correcting for unintended degradation by X-rays in a material undergoing analysis by X-ray photoelectron spectroscopy

1 Scope

This International Standard provides a simple procedure for identifying, estimating and correcting for unintended degradation in the elemental composition or chemical state of a material which occurs as a result of X-radiation during the time that a specimen material is exposed to the X-rays used in X-ray photoelectron spectroscopy (XPS).

This International Standard does not address comparisons between different types of material nor does it address the mechanisms, depth, or chemical nature of the degradation that occurs. The correction procedure proposed is only valid if the changes are caused by the X-rays and result in less than a 30 % reduction or increase in intensity of a chosen photoelectron peak from the sample material.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1
region
part of the photo-excited spectrum chosen for detailed acquisition and analysis

Note 1 to entry: The region may be chosen because it contains a major or minor peak of a given element or to represent the shape or slope of a background within that energy range, e.g. a detail scan.

Note 2 to entry: This usage of region is not to be confused with the area of analysis.

2.2
time zero
time at which the X-rays start to irradiate the sample

3 Symbols and abbreviated terms

A_Z	deduced linear rate of change of $I_{t,Z}$ as a result of degradation for a given element or state
C	atomic fraction of contamination carbon from the quantification computation
$d_{\text{contamination}}$	thickness of a contamination layer on the surface of the sample
DI	degradation index
E	kinetic energy, in eV, of the detected electrons
FWHM	full width at half maximum (intensity)
$I_{Z,\text{corrected}}$	intensity of a given photoelectron peak after correction for the formation of a layer of contamination
$I_{Z,\text{measured}}$	measured intensity of a given photoelectron peak that is influenced by the presence of a layer of contamination
$I_{0,Z}$	undegraded photoelectron intensity of a given element or state, Z
$I_{f,\text{S}}$	final photoelectron intensity of a given element in the survey spectrum
$I_{i,\text{S}}$	initial photoelectron intensity of a given element in the survey spectrum

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