

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

ICS 71.040.40

Confirmed October 2010

National foreword

This British Standard reproduces verbatim ISO 21270:2004 and implements it as the UK national standard.

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

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international publications referred to in this document may be found in the *BSI Catalogue* under the section entitled “International Standards Correspondence Index”, or by using the “Search” facility of the *BSI Electronic Catalogue* or of British Standards Online.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, the ISO title page, pages ii to v, a blank page, pages 1 to 13 and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

Amendments issued since publication

Amd. No.	Date	Comments

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 March 2005

© BSI 31 March 2005

INTERNATIONAL STANDARD

ISO
21270

First edition
2004-06-01

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

*Analyse chimique des surfaces — Spectromètres de photoélectrons X
et d'électrons Auger — Linéarité de l'échelle d'intensité*



Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative reference	1
3 Symbols	1
4 Outline of the methods	2
5 When to use this International Standard	2
6 Procedure for evaluating the intensity linearity	2
6.1 The samples	2
6.2 Preparing the copper sample	3
6.3 Preparing the stainless-steel sample or sample holder	3
6.4 Choosing the spectrometer settings for which the intensity linearity measurement is required	3
6.5 Operating the instrument	3
6.6 Measurement of the intensity scale linearity by varying the source flux	4
6.7 Determination of the intensity scale linearity by varying the source flux	4
6.8 Measurement of the intensity scale linearity in XPS using the spectrum ratio method for systems with two or more but less than 30 X-ray source emission current settings	6
6.9 Determination of the intensity scale linearity in XPS using the spectrum ratio method for systems with two or more but less than 30 X-ray source emission current settings	7
6.10 Completing the analysis	9
Annex A (informative) Example results of linearity measurements using the spectrum ratio method (the second method)	10
Bibliography	13

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 21270 was prepared by Technical Committee ISO/TC 201, *Surface chemical analysis*, Subcommittee SC 7, *X-ray photoelectron spectroscopy*.

Introduction

Quantitative analysis of materials at surfaces by Auger electron spectroscopy (AES) or X-ray photoelectron spectroscopy (XPS), requires measurements of the spectral intensities. Non-linearities in the respective instrument intensity scales, unless corrected, lead directly to errors in the amounts of material determined. In general, intensity scales are linear at very low count rates but become progressively non-linear as the count rates rise. Measurements of intensity rely on the measurement system delivering an intensity signal which is fixed in proportion to the intensity being measured. In counting systems, this proportionality is expected to be unity. If this proportionality varies with the signal level or counting rate, the measurement system is said to be non-linear. It is rare for non-linearities below 1 % to be treated as significant. The intensity scale non-linearity may exceed 1 % for count rates which exceed 5 % of the maximum permissible count rate^[1,2]. For many instruments, the non-linearity behaviour will not vary significantly from month to month, provided the detection system is correctly set. For these instruments, the count rate may be corrected, using the relevant relationship, so that the corrected intensity is then linear for a greatly extended fraction of the maximum obtainable count rate. In this International Standard, two simple relationships are described, involving a parameter known as the detector system dead time, to make this correction. For some instruments, the non-linearity may not be predictable or described by any simple relationship. For these instruments, this International Standard allows the extent of the non-linearity to be measured and a maximum count rate for an acceptable limit of divergence from linearity to be defined. This limit of divergence from linearity is set by the user appropriately for the analyses to be conducted.

In this International Standard, two methods for measuring the linearity are provided. The first is based on the principle that the spectrometer output is proportional to the electron beam current in AES or the X-ray beam flux in XPS^[1]. This is the simplest method and may be conducted in instruments where the beam current or flux may be set at 30 or more approximately evenly spaced intervals up to the level required to generate the maximum count rate for which this International Standard is to be used. In some XPS instruments, this is not possible and the X-ray flux may only be set at one of two or more (but less than 30) pre-defined levels. For these instruments, the first method cannot be realized and a second method is given^[2].

This International Standard should be used when characterising a new spectrometer so that it may be operated in an appropriate count rate range. It is repeated after any substantive modification to the detection circuits, or after the multiplier voltage has been increased (since the previous test with this International Standard) by one-third of the range of increase provided by the manufacturer, or after replacement of the electron multiplier(s) or at intervals of approximately 12 months.