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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 29731-2013

**Surface chemical analysis -- High resolution auger electron
spectrometers -- Calibration of energy scales for elemental and
chemical-state analysis**

表面化学分析 高分辨俄歇电子能谱仪 元素和化学态分析用能量标校准
(English Translation)

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Table of Contents

Preface

Introduction

1 Scope

2 Normative references

3 Terms and definitions

4 Symbols and abbreviations

5 Summary of Method

6 Energy scale calibration step

The maximum number of points in Appendix A (normative) to 0.1eV energy spectrum peaks are spaced Savitzky-Golay smoothing of a single

Appendix B (normative) with a simple method for calculating least squares method to determine the kinetic energy peak

Derivation Annex C (informative) Uncertainty

Annex D (informative) the measured kinetic energy of the uncertainty of reference

References

Foreword

This standard was drafted in accordance with GB/T 1.1-2009 given rules.

This standard uses redrafted Law Amendment uses ISO 17974:2002 "Surface chemical analysis of high resolution Auger electron spectroscopy element Energy and chemical state analysis by standard calibration. " this standard and ISO 17974:2002 technical differences and the following reasons.

--- On normative references, this standard has been adjusted technical differences, in order to adapt our technical conditions, the adjusted situation Focus is reflected in the status of Chapter 2, "Normative references", the specific adjustments are as follows.

- with the GB/T 22461-2008 instead of ISO 18115:2001, IDT;
- increase the GB/T 27025-2008 instead of ISO 17025-2005, MOD.

This standard also made the following editorial changes.

--- The standard name was changed to "surface chemical analysis of high resolution Auger electron spectroscopy and elemental chemical state analysis of energy calibration quasi";

--- The abbreviations, figures, tables, formulas, notes, and normative changes.

The standard micro-beam analysis by the National Standardization Technical Committee (SAC/TC38) and focal points.

This standard was drafted. Tsinghua University, Xiamen University.

Introduction

Auger electron spectroscopy (AES) is widely used for surface analysis of materials. By measuring the spectrum is determined by the Auger electron kinetic energy peaks with different elements the kinetic energy of a list of values or manual alignment of spectrum to identify the samples contained elements other than hydrogen and helium. Information can be chemical states of these elements Auger electron peaks measured with respect to the chemical shift reference state is obtained. Identification of chemical state requirements for chemical shift measurement accuracy up to 0.1eV, one by one the required measurements, and the need for a sufficiently accurate reference source, thus requiring the Auger electron spectroscopy were the kinetic energy standard Calibration is usually uncertainty to $\leq 0.3\text{eV}$.

Kinetic energy calibration method using a metal target sample copper (Cu) and aluminum (Al) specified in this standard, or gold (Au). The calibration method Auger electron spectroscopy for measuring the relative resolution of 0.2% or better direct spectrum. The kinetic energy of its application range for gold is 0 ~ 2250eV, for aluminum, compared with 0 ~ 1550eV.

Auger electron kinetic energy is usually a reference to the vacuum level, such references are still many analysts use. Vacuum level is uncertain, however, not the instrument will vary with 0.5eV or more. Although the use of vacuum level as a reference does not lead to the identification of the elements of fuzzy, but it will lead to the chemical About the state of high-resolution measurement uncertainty. Therefore, in designing Auger electron spectroscopy and X-ray photoelectron spectroscopy with the instrument, the Senate the kinetic energy of the Fermi level test, its value is higher than the reference vacuum level 4.5eV. The kinetic energy of the reference standard Fermi level.

To provide compliance with GB/T 27025 (ISO 17025) [1] analysis requirements, and calibration for other purposes Auger electron spectroscopy, can You can require an estimated calibration uncertainty statement. These instruments are limited within a certain tolerance limit $\pm \Delta$ to give school its kinetic measurements quasi. Δ values in this standard is not specified because it depends on Auger electron spectroscopy application and design may be. Δ value by a user in accordance with this standard Stability of experience, instrument calibration, instrument uncertainty of measurement as well as the kinetic energy of the calibration work required in the intended application the amount of their own choice. This standard can be used to select the appropriate Δ provides value information. Typically $\Delta \geq 0.2\text{eV}$ and larger than the repeatability standard deviation of σ_R 4 times.

For the instrument to be calibrated after a count recorded instrument drift over time, the reference value of the kinetic energy of the discrete plus 95% confidence level is not extended calibration Determined shall not exceed the tolerance limit selected. Before spectrometer may miss school, it should be recalibrated. its calibration measurements and take measures to reduce the difference between the reference value and the measured value. This difference does not have to be reduced to zero, but usually reduced to the analytical work required tolerance limits Several one-half.

Although this standard does not consider all possible defective instrument itself, as required by the test can be very time consuming, and requires both expertise Knowledge and equipment. But the standards discussed the Auger electron spectroscopy kinetic energy standard calibration basic and common problems.

Surface chemical analysis of high resolution Auger electron spectroscopy Elemental analysis and chemical state energy scale calibration

1 Scope

This standard specifies the kinetic energy of the standard calibration method of Auger electron spectroscopy for surface elemental and chemical state analysis. And also provides for calibration Schedule for the energy value in the middle of a test standard linear kinetic energy, kinetic energy at the level of uncertainty from each region one o'clock confirm the scale calibration, Small scale calibration drift, and provisions at 95% confidence level expanded uncertainty of the kinetic energy scale calibration (this includes laboratories of uncertainty Inter study observed phenomena, but does not cover all possible defects).

This standard applies only to sputter ion gun cleaning equipment. Instrument does not apply to the following conditions. Kinetic energy scale with error Nonlinear change significantly; spectrometer resolution at relatively lower than 0.2% fixed $\Delta E/E$ [Delta] E mode or fixed mode when 1.5eV, it requires tolerance limit of $\pm 0.05\text{eV}$ or less. Does not apply to the electron gun can not be the instrument 5keV ~ 10keV energy range operations.

This standard does not provide a full scale calibration test, the test should be verified for each point on the energy scale can be set, and should be the instrument manufacturer 's Recommended procedures.

2 Normative references

The following documents for the application of this document is essential. For dated references, only the dated version suitable for use herein Member. For undated references, the latest edition (including any amendments) applies to this document.

GB/T 22461-2008 Surface chemical analysis - Vocabulary (ISO 18115:2001) GB/T 27025-2008 testing and calibration laboratories General requirements (ISO 17025:2005)

3 Terms and Definitions

Terms and definitions GB/T 22461-2008, as defined in this document apply.

4 Symbols and Abbreviations

This standard uses the following symbols and abbreviations (see Annex B).

AES Auger electron spectroscopy A reduction factor analyzer the proportion of energy a measured error b measured zero offset error in units of eV c R factor d R2 coefficients Results Ecorr kinetic energy after correcting Emeas in units of eV Kinetic Eelem a frequent objective element, whose value has been set on the indicated kinetic energy standard, after calibration can be read out accurately to eV Units Emeas measured kinetic energy in eV units Measuring the average kinetic energy Emeas, n n-th peak, units of eV