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

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**Surface chemical analysis - Electron spectroscopies -
Measurement of the thickness and composition of nanoparticle
coatings**

职业性内照射个人监测规范

(English Translation)

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Foreword

This document is a report-type guidance technical document.

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part 1: Structure and Drafting Rules of Standardization Documents".

Drafting.

This document is equivalent to ISO/T R23173.2021 "Surface chemical analysis - Electron spectroscopy - Thickness and composition of nanoparticle coatings".

Measurement".

The following minimal editorial changes have been made to this document.

- a) The formula number referenced in step d) of the application method in "Descriptive Formulas" has been changed (see 6.5);
- b) Item [35], which was duplicated in Item [25] in the "References" section, was deleted, and the relevant citations in the text were also changed.

Please note that some content in this document may involve patents. The issuing organization of this document assumes no responsibility for identifying patents.

This document was proposed and is under the jurisdiction of the National Technical Committee on Standardization of Surface Chemical Analysis (SAC/TC608).

Introduction

In recent years, nanoparticles have been increasingly developed for applications in a wide range of fields, including catalysis, medicine, energy, optoelectronic devices, and cosmetics.

And use [1]~[7]. In particular, nanoparticles with some form of coating, whether the coating is designed or due to unintended contamination it exists due to processes such as dyeing or oxidation, and is the most common object of research and application [8]~[11]. Because most of the atoms of this material are located on the surface or Interfaces are crucial, therefore, an important part of nanoparticle characterization is the measurement of surface properties. For coated nanoparticles, the thickness and composition of the coating layer are important factors.

Particles play a crucial role in determining their functional properties and defining the interaction between particles and their environment. To achieve the desired performance, many applications require the goal is to find nanoparticles with specially designed coatings. Measuring the surface composition of nanoparticles and the thickness of the coatings is challenging due to the limitations of electron spectroscopy.

It possesses high surface sensitivity, a well-established physical principle, and is readily available, making it a very suitable choice. This type of measurement is suitable for various sample types and...

The conditions are highly dependent; for information on sample preparation and sources of nanoparticles in surface chemical analysis, please refer to reference [12]. Regarding nanostructures...

The challenges of surface chemical analysis of structural materials are summarized in reference [13].

Surface chemical analysis of nanoparticles using electron spectroscopy Measurement of coating thickness and composition

1 Scope

This document describes the use of electron spectroscopy to determine the coating thickness of core-shell nanoparticles (including some variants and non-ideal morphologies).

Methods involving chemical composition are discussed. The assumptions, challenges, and uncertainties of each method are clearly defined. This document also describes the application of electronic spectroscopy to nanoparticles.

Procedures and issues in routine analysis of particle samples, especially their importance for measuring coating thickness.

This document focuses on the use of electron spectroscopy techniques, particularly X-ray photoelectron spectroscopy (XPS), Auger electron spectroscopy (AES), and...

Synchrotron radiation-based methods. These methods cannot provide all the information needed for accurate analysis; therefore, this document outlines some additional methods.

The analytical methods can, to some extent, help interpret electronic energy spectrum data.

2 Normative references

The contents of the following documents, through normative references within the text, constitute essential provisions of this document. Dated citations are not included.

For references to documents, only the version corresponding to that date applies to this document; for undated references, the latest version (including all amendments) applies.

This document.

Note: GB/T 22461.1-2023 Surface Chemical Analysis Vocabulary Part 1: General Terminology and Spectroscopic Terminology (ISO 18115-1:2013, IDT) Vocabulary-Part 2:

Terms used in scanning-probe microscopy) Note. GB/T 22461.2-2023 Surface Chemical Analysis Vocabulary Part 2: Scanning Probe Microscopy Terminology (ISO 18115-2:2013, MOD)

3 Terms and Definitions

The terms and definitions defined in ISO 18115-1 and ISO 18115-2 apply to this document.

4 Symbols and Abbreviations

The following symbols and abbreviations apply to this document.

X. as a subscript, it indicates the coating material.

Y. As a subscript, it indicates the core material.

x. as a subscript, it indicates a specific photoelectron peak from material X.

y. as a subscript, it indicates a specific photoelectron peak from material Y.

li. Electron intensity from peak i.

li,l. Electron intensity of peak i from pure material l.

a. The longitudinal thickness of the overlay material at a given location.

b. The longitudinal thickness of the core material at a given location.

Li,J. The effective attenuation length of electrons from peak i through material J.