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

GB/T 17359-2023

Replacing GB/T 17359-2012

**Microbeam analysis - Quantitative analysis using
energy-dispersive spectrometry (EDS) for elements with an
atomic number of 11 (Na) or above**

微束分析 原子序数不小于11的元素能谱法定量分析

(English Translation)

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Foreword

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 replaces GB/T 17359-2012 "Quantitative Analysis by Microbeam Analysis Energy Spectroscopy": Compared with GB/T 17359-2012, except for the in addition to structural adjustments and editorial changes, the main technical changes are as follows:

- a) Absorption correction, atomic number correction, Bremsstrahlung radiation, certified reference material, electron probe microanalysis, fluorescence correction, incident were deleted Terms and definitions of electron beam energy, EDS quantitative analysis, traceability, and X-ray absorption (see 3.1, 3:4, 3:7,:2012 edition 3:8, 3:12, 3:15, 3:17, 3:24, 3:32, 3:35);
- b) Changed the terms and definitions of energy resolution and spatial resolution (see 3.21, 3:22, 3:28, 3:29 of the:2012 edition);
- c) Changed the requirements for sample uniformity (see 4.2, 4:2 of the:2012 edition);
- d) Changed the requirements for removing contaminants on the surface of the specimen (see 4.3, 4:3 of the:2012 edition);
- e) Changed the requirements for sample preparation (see 4.5, 4:5 of the:2012 edition);
- f) Changed the requirements for sample conductivity (see 4.6,:2012 version of 4:6);
- g) Changed the requirements for reference materials (see 4.8, 4:8 of the:2012 edition);
- h) Changed the requirements for detectors (see 5.5,:2012 version of 5:5);
- i) The requirements for accelerating voltage have been changed (see 6.1, 6:1 of the:2012 edition);
- j) Changed the requirements for the system count rate range (see 6.2, 6:2 of the:2012 version);
- k) Changed the requirements for selecting the analysis location (see 6.5, 6:5 of the:2012 version);
- l) Changed the requirements for peak identification (see 7.2,:2012 version of 7:2);
- m) Changed the requirements for reference material application (see 7.6,:2012 version of 7:6);
- n) Changed the requirements for validation of analytical methods (see 7.8:2,:2012 version of 7:8:2);
- o) Changed the requirements for normalization of analysis results [see 7.9j),:2012 version of 7:9j)]:

This document is modified to adopt ISO 22309:2011 "Microbeam analysis of elements with atomic number greater than or equal to 11 (Na) by energy spectrometry:

Analysis":

Compared with ISO 22309:2011, this document has made the following structural adjustments:

---The order of the appendices has been adjusted according to the order in which they are

mentioned in the text:

The technical differences between this document and ISO 22309:2011 and their reasons are as follows:

- Replaced ISO 15632:2002 (see 5.1, 5:4, 5:5) with the normatively quoted GB/T 20726-2015 to adapt to my country's Technical conditions to increase operability;
- Replaced ISO/IEC 17025:2005 (see 7.9) with normatively quoted GB/T 27025-2019 to adapt to my country's technology technical conditions to increase operability;
- Replaced ISO 14594 [see 6.1c)] with normatively cited GB/T 30705 to adapt to my country's technical conditions and increase the availability operability;
- Replaced ISO 16700 (see 6.3) with normatively quoted GB/T 27788 to adapt to my country's technical conditions and increase operability work nature;
- Deleted the words "absorption correction, atomic number correction, Bremsstrahlung radiation, certified reference materials, electron probe microanalysis, Fluorescence correction, incident electron beam energy, EDS quantitative analysis, traceability, X-ray absorption" terms and definitions to comply with our country's Standard writing rules;
- Modify the terms and definitions of energy resolution and spatial resolution to make it more clearly distinguish between energy resolution and spatial resolution:

rate (see 3.20, 3:21):

The following editorial changes have been made to this document:

- Deleted the note of ISO 22309.20113:16 (see 3.10):

Please note that some content in this document may be subject to patents: The publisher of this document assumes no responsibility for identifying patents:

Introduction

The high-energy electron beam acts on the sample to produce X-rays, which have different characteristics depending on the chemical composition (atom type) in the sample:

And have different energies (wavelengths): The X-ray intensity of each element is related to the content of that element in the sample: If it were possible to measure these X-ray intensities are compared with the X-ray intensities of an appropriate reference material or a group of reference materials, and are calibrated using appropriate methods:

Yes, then the content of each element can be measured: The "no standard sample" program can also provide quantitative results of the sample, but it must be stored in the software:

A previously measured reference X-ray intensity in the package or a theoretically calculated

X-ray intensity is compared to this: This is based on some false the test accuracy of the designed procedure is bound to be lower than the test accuracy of the reference material method (see references [1]~[8]): Detect featureX There are two common methods of ray analysis: wave spectroscopy (WDX) and energy spectroscopy (EDS): The method used in this paper is energy spectroscopy:

When analyzed by energy spectroscopy, the quantitative analysis of light elements [elements with atomic number $Z < 11$ (Na)] is more complicated: This paper discusses a some issues related to this aspect:

Microbeam analysis of elements with atomic number no less than 11 Quantitative analysis by energy spectroscopy

1 Scope

This document describes the use of an energy spectrometer mounted on a scanning electron microscope (SEM) or electron microprobe (EPMA) to analyze specific points or specific Methods for quantitative analysis of areas: Quantitative analysis refers to expressing the content of elements in mass fraction (percentage): Correctly identify all the Elements are an essential part of quantitative analysis, therefore, this document also covers this aspect: This document describes various energy spectroscopy methods Quantitative analysis methods:

This document is applicable to the analysis of elements with a mass fraction higher than 1% and atomic number $Z > 10$ using reference materials or the "no standard sample" procedure:

Quantitative analysis:

This document also gives information on analytical methods for light elements with atomic numbers less than 11:

Note: When there are no overlapping peaks and the corresponding characteristic X-rays are strongly excited, the energy spectrometer can also measure elements with mass fractions at the 0.1% level: Book the document is mainly used for quantitative analysis of samples with flat surfaces: The basic method is also suitable for the analysis of samples with uneven surfaces, but it will introduce additional uncertainties:

Quantity:

There is currently no recognized accurate energy spectroscopy (EDS) quantitative analysis method for light elements: The following are several commonly used methods for light element analysis:

EDS method:

a) Measure peak areas and compare peak intensities: For reasons stated in Appendix A,