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GB/T 47187-2026

Microbeam analysis - Volume electron microscopy - FIB-SEM imaging method for the 3D structure of biological samples

微束分析 体电子显微术 生物样品的聚焦离子束-扫描电镜三维成像方法

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Foreword

This document is in accordance with GB/T 1.1-2020 "Standardization Work Guidelines Part

1.Structure and Drafting Rules of Standardization Documents". Drafting is scheduled. 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 Microbeam Analysis (SAC/TC38). This document was drafted by: Zhejiang University, Southern University of Science and Technology, Naval Medical University of the Chinese People's Liberation Army, Westlake University, Peking University. Ningbo University and the Ninth People's Hospital affiliated to Shanghai Jiao Tong University School of Medicine. The main drafters of this document are. Hong Jian, Guo Jiansheng, Xie Li, Wang Guan, Zhu Jian, Yang Yongji, Shao Meng, Liu Yiqun, Zhang Xing, Wang Hua, and Mao Qianzhuo. Cao Mi.

3D imaging technology reveals the three-dimensional structure of intact cells, tissues, and small model organisms at nanometer resolution, acquiring three-dimensional information about the internal structure of samples. This provides a comprehensive view and greatly improves the reliability of experimental data. The technique utilizes various methods such as continuous ultrathin slicing, sequential block surface cutting, or focused ion beam cutting. This method obtains continuous two-dimensional ultrastructural information of biological samples, using high-resolution scanning electron microscopy or transmission electron microscopy as imaging tools. The process involves three-dimensional reconstruction using computer software to ultimately obtain a three-dimensional image of the internal structure of the biological sample. This includes focused ion beam-scanning electron microscopy (FIBMS). With a resolution of up to 3 nm, it is one of the best methods for three-dimensional reconstruction of small-volume biological samples. The development

of this document will help standardize the aggregation of biological samples. Methods for sample preparation and image data acquisition using pyroion beam scanning electron microscopy. Microbeam analysis of biological samples using volumetric electron microscopy Focused Ion Beam Scanning Electron Microscopy Three-Dimensional Imaging Method

1 Scope

GB/T 47187-2026 is the Chinese national standard covering FIB-SEM tomography of tissue - a focused ion beam shaves off a few nanometres, the electron microscope images the new face, and the cycle repeats, building a three-dimensional reconstruction of cells and organelles at a resolution no optical method reaches. It fixes the sample preparation and staining, the milling and imaging parameters, the alignment and reconstruction, and the reporting. First edition. It was issued on 27 February 2026 and has been in force since 1 September 2026, as a first edition. The document is under the responsibility of the Standardization Administration of China. This page is published from the official record of the 2026 edition; the clause text of a standard this recent is not yet in circulation, and the figures, limits and tables it contains are those of the document itself, delivered in full with the English translation.

This document describes a method for three-dimensional imaging of biological samples based on room-temperature focused ion beam scanning electron microscopy. This document applies to various types of room-temperature focused ion beam scanning electron microscopes used for the examination of biological samples such as cells, plant and animal tissues, and microorganisms. Three-dimensional imaging.

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.

GB/T 45459-2025 Sample preparation method for focused ion beam transmission electron microscopy (FIBEM)

GB/T 45468-2025 Microbeam Analysis of Rock Micropores. Focused Ion Beam-Scanning Electron Microscopy Three-Dimensional Imaging Method

3 Terms and Definitions

The terms and definitions defined in GB/T 45459-2025 and GB/T 45468-2025, as well as the following terms and definitions, apply to this document.

3.1 By performing continuous ultrathin cutting on millimeter-scale samples, and then collecting sequential electrical data from the obtained continuous ultrathin slices or continuously exposed surfaces, the following methods were employed. This technique involves reconstructing high-resolution, large-scale three-dimensional images to obtain three-dimensional structural information within a certain volume of a sample.

3.2 Focused ion beam (FIB) A focused ion beam is used to bombard the sample surface, and the scanning or processing trajectory, step size, and dwell time of the ion beam are controlled by a computer. The system integrates intervals and cycle counts to enable the imaging, etching, induced deposition, and implantation of materials for analytical processing. [Source: GB/T 45468-2025, 3.1, with modifications]

3.3 Micro-nano fabrication and imaging instruments with FIB and scanning electron microscopy imaging systems.

Note. This instrument consists of an ion optical system, a pattern generator, an electron optical system, a sample chamber, a signal acquisition and processing system, and a vacuum system. [Source: GB/T 45468-2025, 3.2, with modifications]

3.4 Heavy metal staining Biological samples are stained with heavy metal compound staining agents to cause different amounts of heavy metals to adsorb onto cellular structures or macromolecules in the samples. Metals are used to enhance the image contrast of ultrastructures in samples.