International Standard

ISO 25498

Microbeam analysis — Analytical electron microscopy — Selected area electron diffraction analysis using a transmission electron microscope

Analyse par microfaisceaux — Microscopie électronique analytique — Analyse par diffraction par sélection d'aire au moyen d'un microscope électronique en transmission

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 202, *Microbeam analysis*, Subcommittee SC 3, *Analytical electron microscopy*.

This third edition cancels and replaces the second edition (ISO 25498:2018), which has been technically revised.

The main changes are as follows:

— Scope has been revised;

— ISO/IEC 17025 has been moved from normative references to bibliography;

— Figure 1 has been replaced;

— Subclause 6.3 has been deleted;

— Subclause 8.3.6 has been deleted, the content of 8.3.6 has been moved to 8.3.2;

— Subclause 9.2.5 has been added and the following subclause has been renumbered;

— Clause 11 has been revised, 11.1,11.2,11.3 and 11.4 have been added;

— Subclauses B.4.1 and B.4.2 have been added;

— Bibliography has been updated and ISO/IEC Guide 98-3 (GUM:1995) has been added.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Electron diffraction techniques are widely used in transmission electron microscopy (TEM) studies. Applications include phase identification, determination of the crystallographic lattice type and lattice parameters, crystal orientation and the orientation relationship between two phases, phase transformations, habit planes and defects, twins and interfaces, as well as studies of preferred crystal orientations (texture). While several complementary techniques have been developed, for example microdiffraction, nano-diffraction, convergent beam diffraction and reflected diffraction, the selected area electron diffraction (SAED) technique is the most frequently employed.

This technique allows direct analysis of small areas on thin specimens from a variety of crystalline substances. It is routinely performed on most TEMs in the world. The SAED is also a supplementary technique for acquisition of high-resolution images, microdiffraction or convergent beam diffraction studies. The information generated is widely applied in studies for the development of new materials, improving structure and/or properties of various materials as well as for inspection and quality control purpose.

The basic principle of the SAED method is described in this document. The experimental procedure for the acquirement of SAED patterns, indexing of the diffraction patterns and determination of the diffraction constant are specified. ISO 25498 is intended for use or reference as technical regulation for transmission electron microscopy.

Microbeam analysis — Analytical electron microscopy — Selected area electron diffraction analysis using a transmission electron microscope

1 Scope

This document specifies the method for selected area electron diffraction (SAED) analysis using a transmission electron microscope (TEM) to analyse thin crystalline specimens. This document applies to test areas of micrometres and sub-micrometres in size. The minimum diameter of the selected area in a specimen which can be analysed by this method is restricted by the spherical aberration coefficient of the objective lens of the microscope and approaches hundreds of nanometres for a modern TEM.

When the size of an analysed specimen area is smaller than the spherical aberration coefficient restriction, this document can also be used for the analysis procedure. However, because of the effect of spherical aberration and deviation of the specimen height position, some of the diffraction information in the pattern can be generated from outside of the area defined by the selected area aperture. In such cases, the use of microdiffraction (nano-beam diffraction) or convergent beam diffraction, where available, can be preferred.

This document is applicable to the acquisition of SAED patterns from crystalline specimens, indexing the patterns and calibration of the camera constant.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and abbreviations

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1 Terms and definitions

3.1.1
Miller notation
indexing system for crystallographic planes and directions in crystals, in which a set of lattice planes or directions is described by three axes coordinate

3.1.2
Miller-Bravais notation
indexing system for crystallographic planes and directions in hexagonal crystals, in which a set of lattice planes or directions is described by four axes coordinate

3.1.3
interplanar spacing
d_{hkl}
perpendicular distance between consecutive planes of the crystallographic plane set *(hkl)*