BS ISO 22493:2014

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Microbeam analysis — Scanning electron microscopy — Vocabulary

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National foreword

This British Standard is the UK implementation of ISO 22493:2014. It supersedes BS ISO 22493:2008 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee CII/9, Microbeam analysis.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
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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 documents 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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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 202, *Microbeam analysis*, Subcommittee SC 1, *Terminology*.

This second edition cancels and replaces the first edition (ISO 22493:2008), of which it constitutes a minor revision.

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Introduction

The scanning electron microscopy (SEM) technique is used to observe and characterize the surface morphology and structure of solid materials, such as metal alloys, ceramics, glasses, minerals, polymers, powders, etc., on a spatial scale of micrometer down to nanometer laterally. In addition, three-dimensional structure can be generated by using a combination of focused ion beam and scanning-electron-based analysis techniques. The SEM technique is based on the physical mechanism of electron optics, electron scattering and secondary electron emission.

As a major sub-field of microbeam analysis (MBA), the SEM technique is widely applied in diverse sectors (high-tech industries, basic industries, metallurgy and geology, biology and medicine, environmental protection, trade, etc.) and has a strong business base that needs standardization.

Standardizing the terminology of a technical field is one of the basic prerequisites for development of standards on other aspects of that field.

This International Standard is relevant to the need for an SEM terminology that contains consistent definitions of terms as they are used in the practice of scanning electron microscopy by the international scientific and engineering communities that employ the technique. This International Standard is the second one developed in a package of standards on electron probe microanalysis (EPMA), scanning electron microscopy (SEM), analytical electron microscopy (AEM), energy-dispersive X-ray spectroscopy (EDS), etc., developed or to be developed by Technical Committee ISO/TC 202, *Microbeam analysis*, Subcommittee SC 1, *Terminology*, to cover the complete field of MBA.

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INTERNATIONAL STANDARD ISO 22493:2014(E)

Microbeam analysis — Scanning electron microscopy — Vocabulary

1 Scope

This International Standard defines terms used in the practice of scanning electron microscopy (SEM). It covers both general and specific concepts, classified according to their hierarchy in a systematic order, with those terms that have already been defined in ISO 23833 also included, where appropriate.

This International Standard is applicable to all standardization documents relevant to the practice of SEM. In addition, some clauses of this International Standard are applicable to documents relevant to related fields (e.g. EPMA, AEM, EDS) for the definition of terms which are relevant to such fields.

2 Abbreviated terms

AEM	analytical electron microscope/microscopy
BSE (BE)	backscattered electron
CPSEM	controlled pressure scanning electron microscope/microscopy
CRT	cathode ray tube
EBIC	electron beam induced current
EBSD	electron backscatter/backscattering diffraction
EDS	energy-dispersive spectrometer/spectrometry
EPMA	electron probe microanalyser/analysis
ESEM	environmental scanning electron microscope/microscopy
FWHM	full width at half maximum
SE	secondary electron
SEM	scanning electron microscope/microscopy
VPSEM	variable-pressure scanning electron microscope/microscopy

3 Terms and definitions used in the physical basis of SEM

3.1
electron optics
science that deals with the passage of electrons through electrostatic and/or electromagnetic fields

3.1.1
electron source
device that generates electrons necessary for forming an electron beam in the electron optical system

3.1.1.1
energy spread
diversity of energy of electrons

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3.1.1.2
effective source size
effective dimension of the electron source

3.1.2
electron emission
ejection of electrons from the surface of a material under given excitation conditions

3.1.2.1
field emission
electron emission caused by the strong electric field on and near the surface of a material

3.1.2.1.1
cold field emission
field emission in which the emission process relies purely on the high-strength electrostatic field in a high-vacuum environment with the cathode operating at ambient temperature

3.1.2.1.2
thermal field emission
Schottky emission
field emission in which the emission process relies on both the elevated temperature of the cathode tip and an applied electric field of high voltage in a high-vacuum environment

3.1.2.2
thermionic emission
electron emission that relies on the use of high temperature to enable electrons in the cathode to overcome the work function energy barrier and escape into the vacuum

3.1.3
electron lens
basic component of an electron optical system, using an electrostatic and/or electromagnetic field to change the trajectories of the electrons passing through it

3.1.3.1
electrostatic lens
electron lens employing an electrostatic field formed by a specific configuration of electrodes

3.1.3.2
electromagnetic lens
electron lens employing an electromagnetic field formed by a specific configuration of electromagnetic coil (or permanent magnet) and pole piece

3.1.4
focusing
aiming the electrons onto a particular point using an electron lens

3.1.5
demagnification
numerical value by which the diameter of the electron beam exiting a lens is reduced in comparison to the diameter of the electron beam entering the lens

3.2
electron scattering
electron deflection and/or its kinetic energy loss as a result of collision(s) with target atom(s) or electron(s)

3.2.1
elastic scattering
electron scattering in which energy and momentum are conserved in the collision system

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