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BSI Standards Publication

Nanotechnologies — Vocabulary

Part 6: Nano-object characterization

bsi.

National foreword

This Published Document is the UK implementation of CEN ISO/TS 80004-6:2021. It is identical to ISO/TS 80004-6:2021. It supersedes PD CEN ISO/TS 80004-6:2015, which is withdrawn.

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European foreword

This document (CEN ISO/TS 80004-6:2021) has been prepared by Technical Committee ISO/TC 229 "Nanotechnologies" in collaboration with Technical Committee CEN/TC 352 “Nanotechnologies” the secretariat of which is held by AFNOR.

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Endorsement notice

The text of ISO/TS 80004-6:2021 has been approved by CEN as CEN ISO/TS 80004-6:2021 without any modification.

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 229, *Nanotechnologies*, in collaboration with Technical Committee IEC/TC 113, *Nanotechnology for electrotechnical products and systems* and with the European Committee for Standardization (CEN) Technical Committee CEN/TC 352, *Nanotechnologies*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO/TS 80004-6:2013), which has been technically revised throughout.

A list of all parts in the ISO/TS 80004 series can be found on the ISO website.

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

Measurement and instrumentation techniques have effectively opened the door to modern nanotechnology. Characterization is key to understanding the properties and function of all nano-objects.

Nano-object characterization involves interactions between people with different backgrounds and from different fields. Those interested in nano-object characterization might, for example, be materials scientists, biologists, chemists or physicists, and might have a background that is primarily experimental or theoretical. Those making use of the data extend beyond this group to include regulators and toxicologists. To avoid any misunderstandings, and to facilitate both comparability and the reliable exchange of information, it is essential to clarify the concepts, to establish the terms for use and to establish their definitions.

The terms are classified under the following broad headings:

— Clause 3: General terms;

— Clause 4: Terms related to size and shape measurement;

— Clause 5: Terms related to chemical analysis;

— Clause 6: Terms related to measurement of other properties.

These headings are intended as a guide only, as some techniques can determine more than one property. Subclause 4.1 lists the overarching measurands that apply to the rest of Clause 4. Other measurands are more technique-specific and are placed in the text adjacent to the technique.

It should be noted that most techniques require analysis in a non-native state and involve sample preparation, e.g. placing the nano-objects on a surface or placing them in a specific fluid or vacuum. This could change the nature of the nano-objects.

The order of the techniques in this document should not be taken to indicate a preference and the techniques listed in this document are not intended to be exhaustive. Equally, some of the techniques listed in this document are more popular than others in their usage in analysing certain properties of nano-objects. Table 1 lists alphabetically the common techniques for nano-object characterization.

Subclause 4.5 provides definitions of microscopy methods and related terms. When abbreviated terms are used, note that the final “M”, given as “microscopy”, can also mean “microscope” depending on the context. For definitions relating to the microscope, the word “method” can be replaced by the word “instrument” where that appears.

Clause 5 provides definitions of terms related to chemical analysis. For these abbreviated terms, note that the final “S”, given as “spectroscopy”, can also mean “spectrometer” depending on the context. For definitions relating to the spectrometer, the word “method” can be replaced by the word “instrument” where that appears.

This document is intended to serve as a starting reference for the vocabulary that underpins measurement and characterization efforts in the field of nanotechnologies.

Table 1 — Alphabetical list of the common techniques for nano-object characterization

Property	Common techniques
Size	centrifugal liquid sedimentation (CLS) atomic-force microscopy (AFM) differential mobility analysing system (DMAS) dynamic light scattering (DLS) variants of inductively coupled plasma mass spectrometry (ICP-MS) particle tracking analysis (PTA) scanning electron microscopy (SEM) small-angle X-ray scattering (SAXS) transmission electron microscopy (TEM)
Shape	atomic-force microscopy (AFM) scanning electron microscopy (SEM) transmission electron microscopy (TEM)
Surface area	Brunauer–Emmett–Teller (BET) method
“Surface” chemistry	Raman spectroscopy secondary-ion mass spectrometry (SIMS) X-ray photoelectron spectroscopy (XPS)
Chemistry of the “bulk” sample	energy-dispersive X-ray spectroscopy (EDX) inductively coupled plasma mass spectrometry (ICP-MS) nuclear magnetic resonance (NMR) spectroscopy
Crystallinity	selected area electron diffraction (SAED) X-ray diffraction (XRD)
Electrokinetic potential in suspensions	electrophoretic mobility

Nanotechnologies — Vocabulary —

Part 6: Nano-object characterization

1 Scope

This document defines terms related to the characterization of nano-objects in the field of nanotechnologies.

It is intended to facilitate communication between organizations and individuals in research, industry and other interested parties and those who interact with them.

2 Normative references

There are no normative references in this document.

3 Terms and definitions (General terms)

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

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

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

3.1
nanoscale
length range approximately from 1 nm to 100 nm

Note 1 to entry: Properties that are not extrapolations from a larger size are predominantly exhibited in this length range.

[SOURCE: ISO/TS 80004-1:2015, 2.1]

3.2
nano-object
discrete piece of material with one, two or three external dimensions in the *nanoscale* (3.1)

Note 1 to entry: The second and third external dimensions are orthogonal to the first dimension and to each other.

[SOURCE: ISO/TS 80004-1:2015, 2.5]

3.3
nanoparticle
nano-object (3.2) with all external dimensions in the *nanoscale* (3.1) where the lengths of the longest and the shortest axes of the nano-object do not differ significantly

Note 1 to entry: If the dimensions differ significantly (typically by more than three times), terms such as *nanofibre* (3.6) or *nanoplate* (3.4) may be preferred to the term “nanoparticle”.

[SOURCE: ISO/TS 80004-2:2015, 4.4]