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Nanotechnologies - Vocabulary - Part 1: Core vocabulary (ISO 80004-1:2023)

Nanotechnologien - Fachwörterverzeichnis - Teil 1: Zentrales Fachwörterverzeichnis
(ISO 80004-1:2023)

Nanotechnologies - Vocabulaire - Partie 1: Vocabulaire "cœur" (ISO 80004-1:2023)

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ISO/TS 80004-11:2020

English Version

**Nanotechnologies - Vocabulary - Part 1: Core vocabulary
(ISO 80004-1:2023)**

Nanotechnologies - Vocabulaire - Partie 1: Vocabulaire
"cœur" (ISO 80004-1:2023)

Nanotechnologien - Fachwörterverzeichnis - Teil 1:
Zentrales Fachwörterverzeichnis (ISO 80004-1:2023)

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CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (EN ISO 80004-1:2023) 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.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2024, and conflicting national standards shall be withdrawn at the latest by February 2024.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes CEN ISO/TS 80004-4:2014, CEN ISO/TS 80004-1:2015, CEN ISO/TS 80004-2:2017 and CEN ISO/TS 80004-11:2020.

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INTERNATIONAL STANDARD

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First edition
2023-07

Nanotechnologies – Vocabulary — **Part 1:** **Core vocabulary**

Nanotechnologies — Vocabulaire —
Partie 1: Vocabulaire "cœur"

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ISO 80004-1:2023(E)

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 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 jointly by Technical Committee ISO/TC 229, *Nanotechnologies* and Technical Committee IEC/TC 113, *Nanotechnology standardization for electrical and electronic products and systems*, and in collaboration 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). The draft was circulated for voting to the national bodies of both ISO and IEC.

This first edition cancels and replaces ISO/TS 80004-1:2015, ISO/TS 80004-2:2015, ISO/TS 80004-4:2011 and ISO/TS 80004-11:2017, which have been technically revised.

The main changes compared to the previous editions are as follows:

- ISO/TS 80004-1:2015, ISO/TS 80004-2:2015, ISO/TS 80004-4:2011 and ISO/TS 80004-11:2017 merged into one document;
- the definition of nanostructure has been revised;
- the term and definition for NOAA has been added.

A list of all parts in the ISO 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

By control of matter in the nanoscale, nanotechnology brings together processes and techniques that are used to research, design and manufacture materials, devices and systems. It enables management of characteristics such as material size, shape, morphology, chemical composition and molecular configuration for the improvement, or development of, new process and product properties.

Applications of nanotechnologies are expected to impact virtually every aspect of life and enable dramatic advances in communication, health, manufacturing, materials and knowledge-based technologies. There is a need to provide industry and researchers with suitable tools to assist with the development, application and communication of nanotechnologies.

A crucial objective is the harmonization of terminology and definitions, in order to promote common understanding and consistent usage across communities where nanotechnologies are being developed and used. In the context of the ISO 80004 series, “terminology” refers to:

- a) a structured or conceptual presentation of vocabulary employed in nanotechnologies, and
- b) assigned definitions for specific units of the language in this vocabulary.

This document presents terminology and definitions for core terms in this emerging vocabulary and serves as the foundation for a broader vocabulary constituted collectively by the ISO 80004 series.

As nanotechnologies continue to evolve, the terms and definitions to facilitate communications have become increasingly specific and precise. For many communities, the meaning of terms such as nanoscale, nanomaterial and nanotechnology are inferred by logical application of the SI unit of scale. The prefix 'nano-' specifically means a measure of 10^{-9} units and the nature of this unit is determined by the word that follows. In the ISO 80004 series, however, terms such as nano-object and nanoscale employ size and geometric boundaries to express fundamental and measurable aspects of nanomaterials. In the case of the term nanoscale, the definition acknowledges that the length range of nano-objects can fall outside the precise boundaries normally associated with the concept of scale, by indicating that the upper and lower boundaries are approximate.

The lower limit (approximately 1 nm) in the definition of nanoscale is introduced to avoid single and small groups of atoms, as well as individual molecules, from being designated as nano-objects or elements of nanostructures, which can be implied by the absence of a lower limit. It should also be recognized that fullerene molecules and single layer planar structures (e.g. graphene) that have dimensions below 1 nm are, in practice, considered to be nanomaterials because they are important building blocks for nanotechnology.

Further, size-dependent biological effects, specifically particle-cell interactions and environmental interactions related to nanotechnology, involve structures below 1 nm and above 100 nm. In addition to size, the complex interplay of parameters such as aspect ratio, core chemistry, agglomeration state, physical state, surface properties and others will influence biological and environmental interactions associated with nanostructured materials.

Terminology development is proceeding at an intensive pace and needs to be responsive to the needs of stakeholders. As knowledge expands, terminology will need to effectively convey not only the size and shape-based metrics of nanomaterials but also the performance-based/properties-based aspects of intentionally produced nano-objects and nanostructured materials in their definitions.

It will be an on-going challenge to communicate complex concepts in definitions in a manner that is meaningful and practical for stakeholders in research, commercial applications, government and consumer communities. It is emphasized that the definition of “nanoscale” in the ISO 80004 series is a general descriptor serving to facilitate communication concerning nanotechnologies.

The development of core terms and their definitions has benefited from discussions over time concerning scientific, regulatory and consumer usage. The science is still emerging, as is the capacity to measure and characterize nanomaterials or more generally matter in the nanoscale. Care needs to be taken to ensure the latest scientific information is incorporated into the terminology as it becomes