

STN	Nanotechnológie Slovník Časť 1: Základný slovník (ISO 80004-1: 2023)	STN EN ISO 80004-1 60 3030
------------	---	--

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

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 10/23

Obsahuje: EN ISO 80004-1:2023, ISO 80004-1:2023

Oznámením tejto normy sa ruší
STN P CEN ISO/TS 80004-1 (60 3030) z apríla 2016

STN P CEN ISO/TS 80004-11 (60 3030) z decembra 2020

STN P CEN ISO/TS 80004-2 (60 3030) z januára 2018

STN P CEN ISO/TS 80004-4 (60 3030) z apríla 2015

137529

EUROPEAN STANDARD

EN ISO 80004-1

NORME EUROPÉENNE

EUROPÄISCHE NORM

August 2023

ICS 01.040.07; 07.120

Supersedes CEN ISO/TS 80004-4:2014, CEN ISO/TS
80004-1:2015, CEN ISO/TS 80004-2:2017, CEN
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)

This European Standard was approved by CEN on 24 June 2023.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

EN ISO 80004-1:2023 (E)

Contents	Page
European foreword.....	3

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.

Any feedback and questions on this document should be directed to the users' national standards body/national committee. A complete listing of these bodies can be found on the CEN website.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

Endorsement notice

The text of ISO 80004-1:2023 has been approved by CEN as EN ISO 80004-1:2023 without any modification.

INTERNATIONAL STANDARD

ISO 80004-1

First edition
2023-07

Nanotechnologies – Vocabulary — Part 1: Core vocabulary

*Nanotechnologies — Vocabulaire —
Partie 1: Vocabulaire "cœur"*



Reference number
ISO 80004-1:2023(E)

© ISO 2023

ISO 80004-1:2023(E)**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2023

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
3.1 Core terms related to nanotechnologies	1
3.2 Terms related to particles and assemblies of particles	3
3.3 Terms related to nano-objects.....	4
3.4 Terms related to the description of nanostructured material	6
3.5 Terms related to the categories of nanostructured material	6
3.6 Terms related to coatings, layers, films and membranes	6
3.7 Terms related to nanocoatings, nanolayers, nanofilms and related terms.....	7
3.8 Supplementary terms related to nanotechnology	7
Bibliography	10
Index	11

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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 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

ISO 80004-1:2023(E)

available. It is important to acknowledge that the associated terms and their definitions will likewise follow an evolutionary path.

Many of the definitions in this document are determined to be in harmony with a framework and hierarchical system of terminology for nanotechnologies. Furthermore, it is also important to recognize that articles fabricated to contain nanomaterials are not necessarily nanomaterials themselves.

Nano-objects (e.g. nanoparticles, nanofibres and nanoplates), often occur in (large) groups, rather than as isolated or distinct entities. For reasons of surface energy, such coexisting nano-objects are likely to interact. The terms are not restricted with respect to physical size and shape. These terms are included for completeness and importance at the nanoscale.

[Figure 1](#) illustrates the relationships between nanomaterial, nano-object and nanostructured material. However, this hierarchy is not intended to exclude the possibility for a nano-object to have internal or surface nanostructure. [Figure 1](#) should therefore be considered as schematic or idealized.

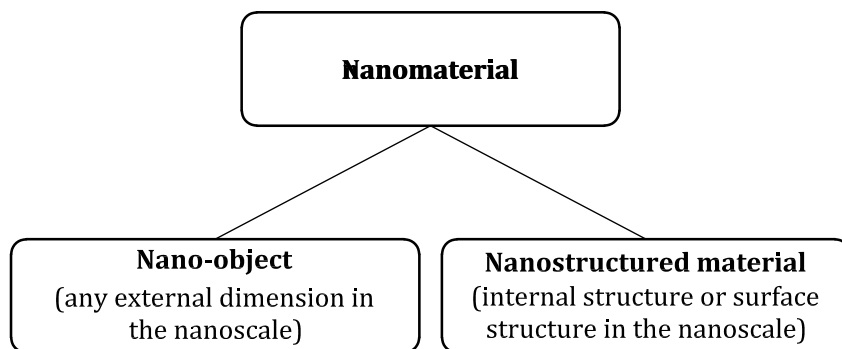


Figure 1 — Nanomaterial framework

A number of other parameters in addition to size and shape are also intrinsic to the function and phenomena exhibited by nano-objects (see [Figure 2](#)). These parameters include composition, morphology, crystalline structure and surface features, which can all have a major influence on the key nanoscale phenomena exhibited by nano-objects. Such phenomena include magnetic, optical, catalytic, electronic and other properties.

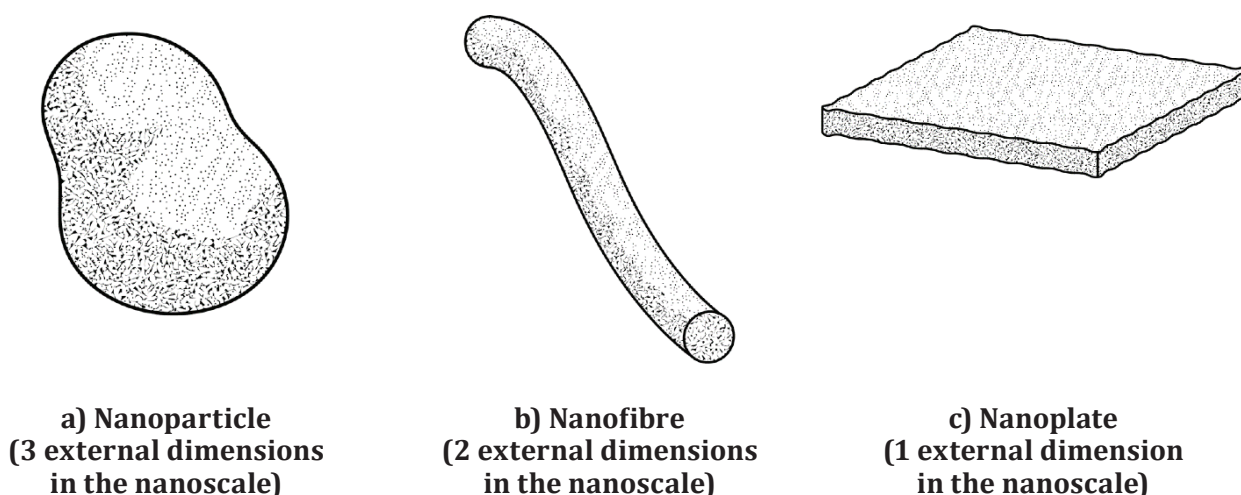


Figure 2 — Schematic diagrams showing some shapes for nano-objects

There is a hierarchical relationship between many of the different terms in this document, elements of which are shown in [Figure 3](#).

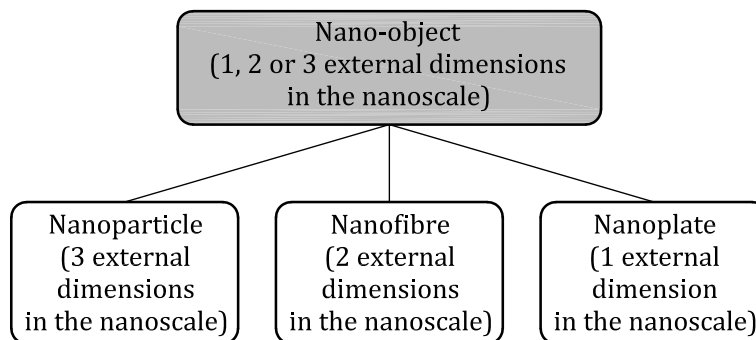


Figure 3 — Fragment of hierarchy of terms related to nano-objects

Nanostructured materials are characterized by internal structures or surface structures at the nanoscale. Nano-objects (material with one, two or three external dimensions in the nanoscale) can be nanostructured.

A material should not be classified as nanostructured based solely on its crystalline properties (three-dimensional arrangements of atoms or molecules forming a crystallite, short range order of atoms in amorphous or quasi-amorphous phases, grain boundaries, intragranular interfaces, dislocations, etc.). In contrast, materials with a grain size distribution having a significant fraction of grains in the nanoscale (nanocrystalline), voids and pores in the nanoscale, or precipitations in the nanoscale (i.e. nano-objects in a solid matrix) are sufficient features for materials to be classified as “nanostructured”. Similarly, almost all materials always have surfaces with morphological and chemical heterogeneities in the nanoscale. Only surfaces that have been intentionally modified or textured to have morphological or chemical heterogeneities in the nanoscale qualify materials as “nanostructured”.

Five categories of nanostructured materials are covered in this document (see [Figure 4](#)):

- a) nanostructured powder;
- b) nanocomposite;
- c) solid nanofoam;
- d) nanoporous material;
- e) fluid nanodispersion.

For some of these five categories, a number of subcategory terms are also defined. The category and subcategory terms are not comprehensive; additional categories and subcategories will be added in later revisions of this document.

ISO 80004-1:2023(E)

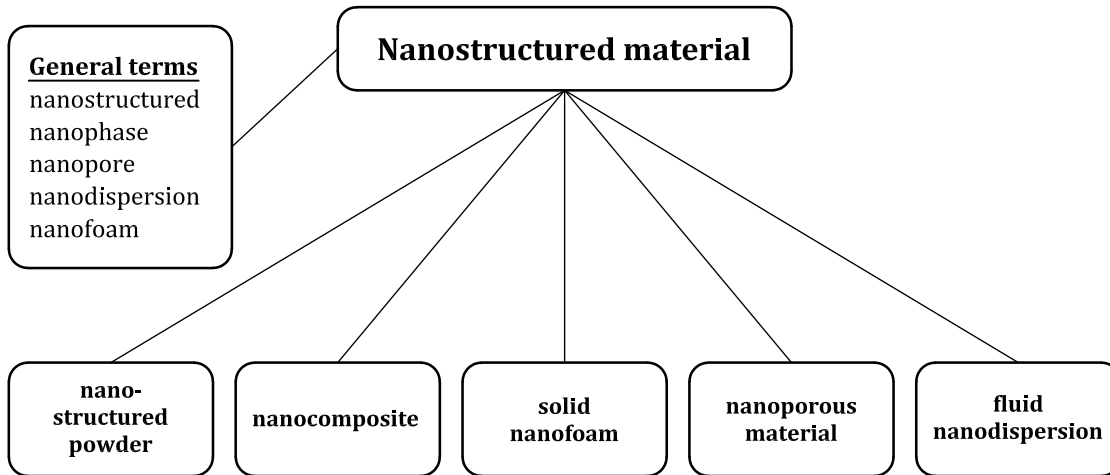


Figure 4 — Categories of nanostructured materials defined in this document

The terms coating, layer, film and others that are related can be grouped by distinguishing between coatings, layers and films having a thickness in the nanoscale (i.e. external dimension in the nanoscale) and those having internal structures in the nanoscale (e.g. nanostructured coatings, nanocomposite coatings, dispersion coatings with dispersed nano-objects). Following the hierarchy established in this document which describes nanomaterial by the two categories 'nano-objects' and 'nanostructured material' the terms nanolayer, nanocoating, and nanofilm are assigned to 'nano-objects' and the terms nanostructured layers, coatings and films are assigned to nanostructured material (see [Figure 5](#)). It is noted that nano-objects (including nanolayers, nanocoatings and nanofilms), can be elements or parts of a larger nanostructured material.

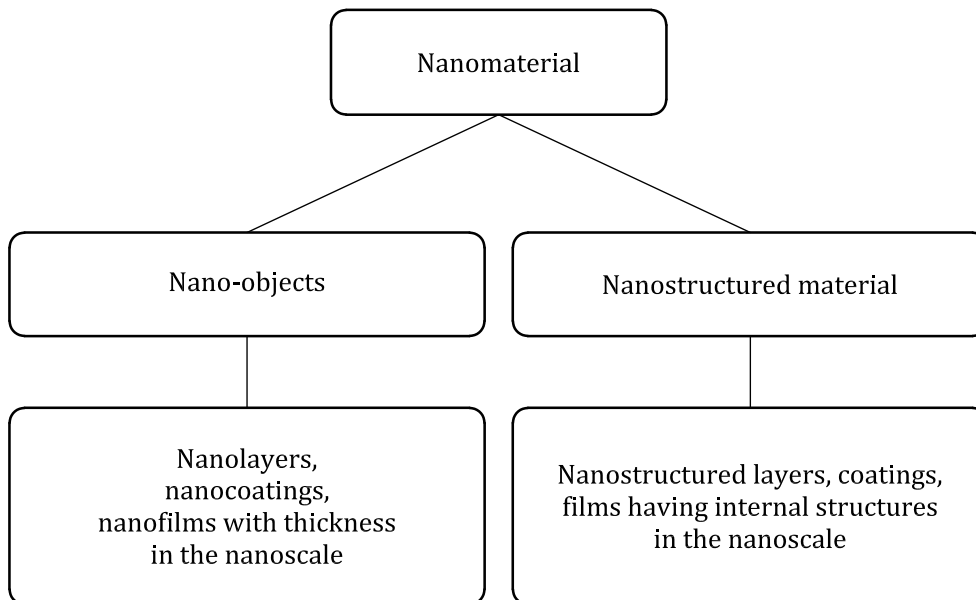


Figure 5 — Assigning the terms nanolayer, nanocoating, nanofilm to "nano-objects" and the terms nanostructured layers, coatings, and films to "nanostructured material" following the hierarchy of nanomaterial terms

Some of the terms defined in this document are also used in other industries. Keeping in mind their special applications, these industries can have slightly different definitions for those terms. In the case of

— pigments, dyestuffs and extenders, ISO 18451-1 can be consulted,

- paints and varnishes, ISO 4618 can be consulted, and
- cleanrooms and associated controlled environments, ISO 14644-3 can be consulted.

These references are available in the ISO online browsing platform.

Nanotechnologies – Vocabulary —

Part 1: Core vocabulary

1 Scope

This document defines core terms in the field of nanotechnology. This document is intended to facilitate communication between organizations and individuals in industry and those who interact with them.

2 Normative references

There are no normative references in this document.

koniec náhľadu – text ďalej pokračuje v platenej verzii STN