AS ISO 80004.1:2026
ISO 80004-1:2023

Nanotechnologies — Vocabulary

Part 1: Core vocabulary



AS ISO 80004.1:2026

This Australian Standard® was prepared by NT-001, Nanotechnologies. It was approved on behalf of Standards Australia's Standards Development and Accreditation Committee on 11 June 2026.

This Standard was published on 26 June 2026.

The following are represented on Committee NT-001:

Adelaide University
Australian Industrial Chemicals Introduction Scheme
Australian Institute of Health & Safety
Australian Nuclear Science and Technology Organisation
Consumers' Federation of Australia
Engineers Australia
National Association of Testing Authorities Australia
National Measurement Institute
Smart Energy Council

This Standard was issued for comment as DR AS ISO 80004.1:2026

Status of this document

Standards Australia publications are periodically reviewed to ensure their ongoing relevance and accuracy. This document may be withdrawn, revised, or superseded at any time. To verify this document's current status, visit:

www.standards.org.au

ISBN: 978 1 76175 819 5

AS ISO 80004.1:2026
ISO 80004-1:2023

Australian Standard®

Nanotechnologies — Vocabulary

Part 1: Core vocabulary

First published as AS ISO 80004.1:2026.

© ISO 2026 — All rights reserved
© Standards Australia Limited 2026

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher, unless otherwise permitted under the Copyright Act 1968 (Cth).

Users must not use the content in this publication in combination with artificial intelligence (AI) tools for any purpose, unless they have the express prior written consent from Standards Australia.

How to read this Standard

This page explains the meaning of the language and structure of this Standard.

Refer to Standards Australia's Standardisation Guide 006 for more details about drafting rules.

Australian and Australian/New Zealand Standards are voluntary unless they are referenced in legislation or called up in contracts.

Requirements

To conform to a Standard, all requirements in the Standard need to be met.

A requirement is any statement in the Standard which uses the word "shall".

Recommendations, permissions and possibilities

The following words are commonly used in Standards, but statements using them do not have to be followed to conform to the Standard:

(a) "should" means that something is recommended.

(b) "may" means that something is permitted.

(c) "can" means that something is possible.

Structure of Standards

A Standard always has the following parts:

(i) The Preface states who developed the Standard, what the Standard is aiming to do, and how it relates to other documents.

(ii) The Scope states what the Standard is about, what it covers and what it does not cover.

(iii) The Normative references clause lists other documents that are referenced in the Standard as part of requirements.

(iv) The Terms and definitions clause defines important terms to help with understanding the Standard.

A Standard may also include other parts, such as the following:

(1) A normative appendix sets additional requirements that need to be conformed to.

(2) An informative appendix provides additional information or guidance. They usually do not contain requirements. If an informative appendix does contain requirements, the Standard will explain when those requirements apply.

(3) A Bibliography lists documents referenced in the Standard but not as part of requirements.

Many Standards include notes. Notes provide recommendations and/or guidance only. They never contain requirements.

Preface

This Standard was prepared by the Standards Australia Committee NT-001, Nanotechnologies.

The objective of this document is to define 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.

This document is identical to, and has been reproduced from, ISO 80004-1:2023, *Nanotechnologies — Vocabulary — Part 1: Core vocabulary.*

The terms “normative” and “informative” are used in Standards to define the application of the appendices or annexes to which they apply. A “normative” appendix or annex is an integral part of a Standard, whereas an “informative” appendix or annex is only for information and guidance.

© Standards Australia Limited 2026

Contents

Page

Preface ..... **v**
Foreword ..... **vii**
Introduction ..... **viii**
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 5
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**

© Standards Australia Limited 2026

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.

© Standards Australia Limited 2026

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 nanostructuredmaterials 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

© Standards Australia Limited 2026

the latest scientific information is incorporated into the terminology as it becomes 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 nanostructuredmaterial. 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.

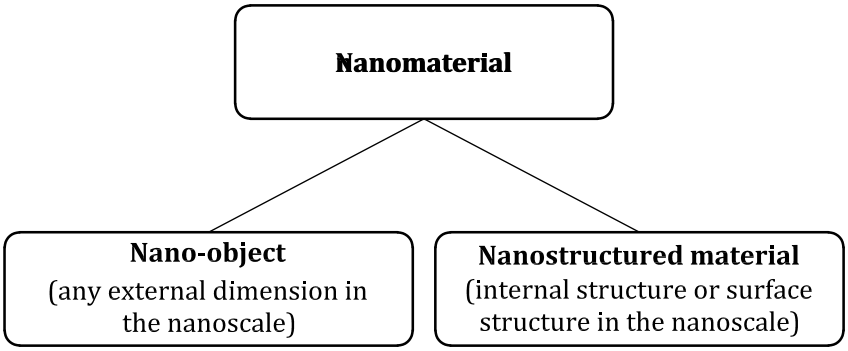
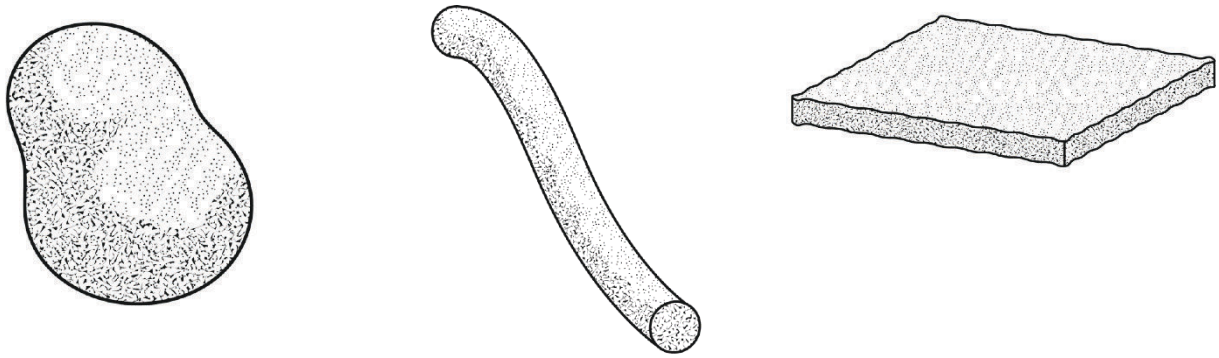


Figure 1 — Nanomaterial framework

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.



a) Nanoparticle (3 external dimensions in the nanoscale)

b) Nanofibre (2 external dimensions in the nanoscale)

c) Nanoplate (1 external dimension in the nanoscale)

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.

© Standards Australia Limited 2026

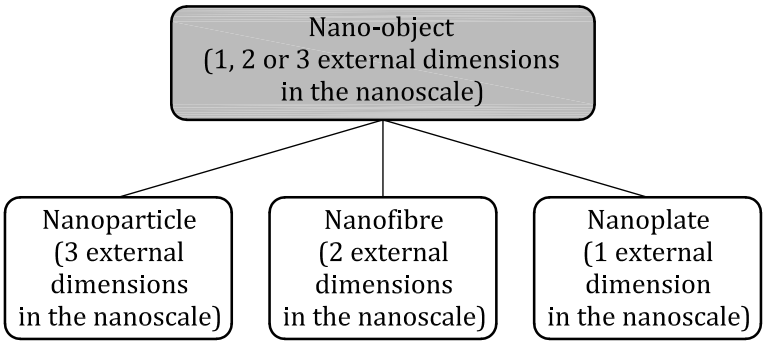


Figure 3 — Fragment of hierarchy of terms related to nano-objects

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.

© Standards Australia Limited 2026

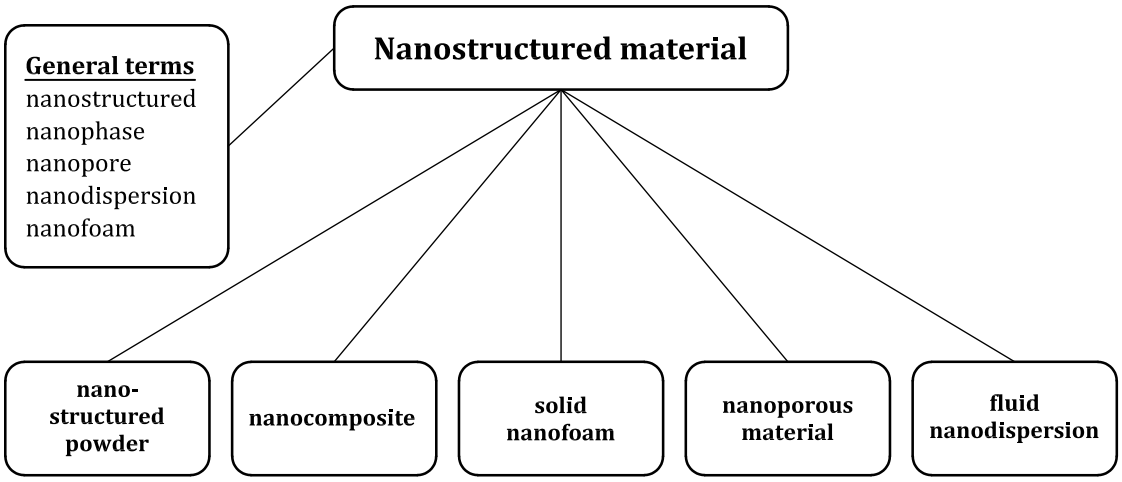


Figure 4 — Categories of nanostructured materials defined in this document

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.

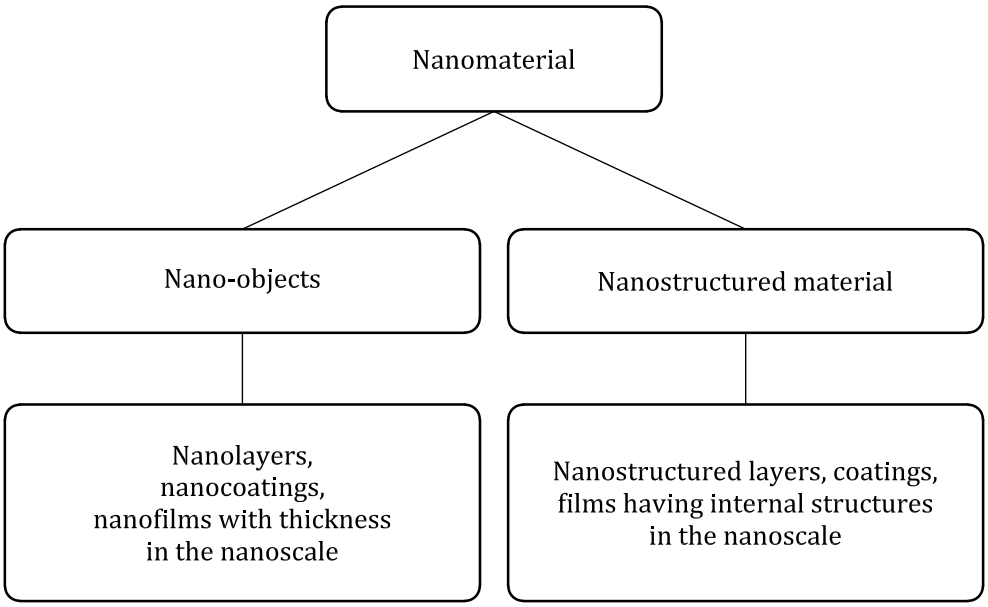


Figure 5 — Assigning the terms nanolayer, nanocoating, nanofilm to "nano-objects" and the terms nanostructured layers, coatings, and films to "nanostructured material" following the hierarchy of nanomaterial terms

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

© Standards Australia Limited 2026

— cleanrooms and associated controlled environments, ISO 14644-3 can be consulted.

These references are available in the ISO online browsing platform.

© Standards Australia Limited 2026

Australian Standard®

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.

3 Terms and definitions

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 Core terms related to nanotechnologies

3.1.1
nanoscale
length range approximately from 1 nm to 100 nm

3.1.2
nanoscience
study, discovery and understanding of matter where size- and structure-dependent properties and phenomena manifest, predominantly in the *nanoscale* (3.1.1), distinct from those associated with individual atoms or molecules, or extrapolation from larger sizes of the same material

3.1.3
nanotechnology
application of scientific knowledge to manipulate and control matter predominantly in the *nanoscale* (3.1.1) to make use of size- and structure-dependent properties and phenomena distinct from those associated with individual atoms or molecules, or extrapolation from larger sizes of the same material

Note 1 to entry: Manipulation and control include, for example, material synthesis and processing.

3.1.4
nanomaterial
material with any external dimension in the *nanoscale* (3.1.1) or having internal structure or surface structure in the nanoscale

Note 1 to entry: See 3.1.8 to 3.1.10 for definitions of certain types of nanomaterial.

Note 2 to entry: The nanoform of a material is a nanomaterial.

3.1.5
nano-object
discrete piece of material with one, two or three external dimensions in the *nanoscale* (3.1.1)

© Standards Australia Limited 2026