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English Version

**Nanotechnologies - Vocabulary - Part 4: Nanostructured
materials (ISO/TS 80004-4:2011)**

Nanotechnologies - Vocabulaire - Partie 4: Matériaux
nanostructurés (ISO/TS 80004-4:2011)

Nanotechnologien - Fachwörterverzeichnis - Teil 4:
Nanostrukturierte Materialien (ISO/TS 80004-4:2011)

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Foreword

The text of ISO/TS 80004-4:2011 has been prepared by Technical Committee ISO/TC 229 "Nanotechnologies" of the International Organization for Standardization (ISO) and has been taken over as CEN ISO/TS 80004-4:2014 by 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 80004-4:2011 has been approved by CEN as CEN ISO/TS 80004-4:2014 without any modification.

Introduction

With increasing scientific knowledge and a growing number of technical terms in this field, the purpose of this Technical Specification is to define important terms for nanostructured materials.

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” (see ISO/TS 80004-1:2010, 2.4, nanomaterial). 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 identify materials as “nanostructured”.

Five categories of nanostructured materials are covered in this Technical Specification (see Figure 1):

- 1) nanostructured powder;
- 2) nanocomposite;
- 3) solid nanofoam;
- 4) nanoporous material;
- 5) 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 Technical Specification.

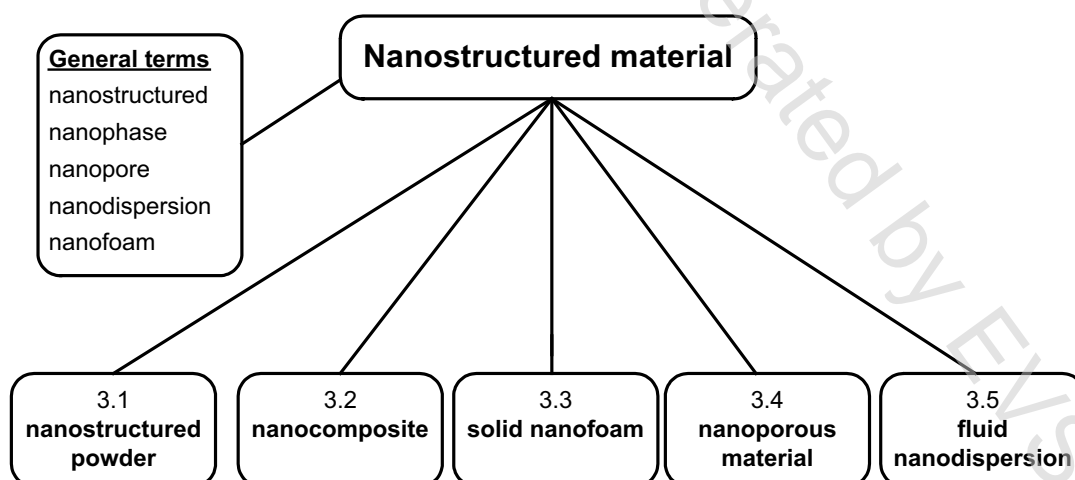


Figure 1 — Categories of nanostructured materials defined in this Technical Specification

In both nanopowders and fluid nanodispersions, the nano-objects (or their aggregates or agglomerates) are arranged in a non-random distribution (generating a short-range order, i.e. a structure). Also, it is recognized that in many cases the nano-objects (or their aggregates or agglomerates) will interact with the molecules of the liquid (particularly in polar liquids) in a thin boundary layer on the surface of each particle. The homogeneity of properties in the liquid is modified in terms of a “nanostructure”. The effects can be revealed by physico-chemical measurements.

If, on the other hand, the liquid medium serves as a background and there is no particular interrelation among the nano-objects contained within it, then such a nanosuspension is not considered “nanostructured” as a whole but rather just as an ensemble of nano-objects. In this sense, the term “nanosuspension” as defined here recognizes a grey zone between nanostructured material and a material consisting of nano-objects. Overall, the conclusion was that the term “nanosuspension” should be included in this Technical Specification because of its current and expanding usage to describe materials in the field.

Nanotechnologies — Vocabulary —

Part 4: Nanostructured materials

1 Scope

This Technical Specification gives terms and definitions for materials in the field of nanotechnologies where one or more components are nanoscale regions and the materials exhibit properties attributable to the presence of those nanoscale regions. It is intended to facilitate communications between organizations and individuals in industry and those who interact with them.

Materials have topographical or compositional features at the nanoscale, but this is not sufficient to classify the material as nanostructured. Materials classified as nanostructured have an internal or surface structure with a significant fraction of features, grains, voids or precipitates in the nanoscale. Articles that contain nano-objects or nanostructured materials are not necessarily nanostructured materials themselves.

This Technical Specification includes nanodispersion.

2 Basic terms used in the description of nanostructured material

2.1

nanoscale

size range from approximately 1 nm to 100 nm

NOTE 1 Properties that are not extrapolations from a larger size will typically, but not exclusively, be exhibited in this size range. For such properties the size limits are considered approximate.

NOTE 2 The lower limit in this definition (approximately 1 nm) is introduced to avoid single and small groups of atoms from being designated as nano-objects or elements of nanostructures, which might be implied by the absence of a lower limit.

[ISO/TS 80004-1:2010, definition 2.1]

2.2

nano-object

material with one, two or three external dimensions in the **nanoscale** (2.1)

NOTE Generic term for all discrete nanoscale objects.

[ISO/TS 80004-1:2010, definition 2.5]

2.3

nanomaterial

material with any external dimension in the **nanoscale** (2.1) or having internal structure or surface structure in the nanoscale

NOTE This generic term is inclusive of **nano-object** (2.2) and **nanostructured material** (2.11).

[ISO/TS 80004-1:2010, definition 2.4]