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## Nanomaterials — Preparation of safety data sheets (SDS)

Nanomatériaux — Préparation des fiches de données de sécurité (FDS)

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## Contents

Foreword.....	iv
Introduction .....	v
1 Scope.....	1
2 Normative references .....	1
3 Terms and definitions.....	1
4 SDS preparation .....	5
4.1 General.....	5
4.2 Content and general layout of an SDS .....	6
4.2.1 Chemical product and company identification.....	6
4.2.2 Hazard identification .....	6
4.2.3 Composition of ingredients and related information .....	7
4.2.4 First-aid measures .....	7
4.2.5 Fire-fighting measures.....	8
4.2.6 Accidental release measures .....	8
4.2.7 Handling and storage .....	9
4.2.8 Exposure controls and personal protection .....	10
4.2.9 Physical and chemical properties .....	11
4.2.10 Stability and reactivity.....	12
4.2.11 Toxicological information .....	12
4.2.12 Ecological information.....	13
4.2.13 Disposal considerations .....	13
4.2.14 Transportation information .....	14
4.2.15 Regulatory information.....	14
4.2.16 Other information .....	14
5 Cut-off values and concentration limits .....	14
Annex A (informative) Example measurement methods and standards (ISO/TR 13014) .....	16
Bibliography .....	25

## 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](http://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](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee 229 Nanotechnologies.

This second edition cancels and replaces the first edition (ISO/TR 13329:2012), which has been technically revised.

The main ~~changes are~~ change is as follows:

- ~~The document has been changed to a Technical Specification.~~

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](http://www.iso.org/members.html).

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## Introduction

This Technical Specification provides guidance on the development of safety data sheets (SDSs) for manufactured nanomaterials (and materials or products that contain manufactured nanomaterials) and provides additional information on safety issues associated with manufactured nanomaterials. (Manufactured nanomaterials are defined as materials that are intentionally produced materials to have specific properties or a specific composition and which have any external dimension in the nanoscale or internal structure or surface structure in the nanoscale). It, This document is not a stand-alone document and should be used in conjunction with ISO 11014:2009[1]. This Technical Specification considers [1] This document takes into account the Globally harmonized system of classification and labelling of chemicals (GHS) document on hazard communication, i.e. safety data sheets. The GHS was developed by the United Nations and is being incorporated into the laws of various regions and nations, many of which already have laws that govern the preparation of SDSs.

Currently, there is limited information on the possible hazards of some nanomaterials. In some cases, the degree of risk to workers or others who can be exposed to nanomaterials is partly unknown, as the possible toxicological effects of nanomaterials are not yet well known and exposure is difficult to measure. Most hazard information and communication approaches require necessitate preparation of an SDS for hazardous chemicals, including those containing nanomaterials, for use in manufacture, storage, transport or other occupational handling activities. Yet, only a few SDSs contain specific information about nanomaterials or are specific to nanomaterials. Those that exist generally provide insufficient hazard information (see Reference [2]-[21]). There is evidence that some nanomaterials can be more hazardous, e.g. more bio-reactive or active, leading to higher toxicity, than the same material in bulk (non-nanoscale) form. Characteristics predictive of potential safety issues or toxicity for manufactured nanomaterials need to be determined and included in the preparation of an SDS. Within the European Union and the UK, the legislation that addresses industrial substances including nanomaterials requires specifies that hazardous substances and mixtures are accompanied by an SDS when placed on the market.

The most fundamental ethical responsibility faced by manufacturers is to make users aware that nanomaterials have been added to a product and to transmit communicate, in an SDS, the hazards the product can present and the most effective ways to mitigate those hazards, relying on the hierarchy of controls, which. The hierarchy of controls is a method that is found in nearly every international guidance document on responsible management of nanomaterials. This Technical Specification document considers the precautionary approach in terms of toxicity and other risks associated with nanomaterials and thus, It recommends providing an SDS for nanomaterials and nanomaterial-containing products, regardless of whether or not the material is classified as hazardous, unless there are existing data for the nanomaterial which demonstrates that it is non-hazardous, or if it is not envisaged that they can be released as nano-objects, or their agglomerates and aggregates greater than 100 nm (NOAA), during handling or use.



# Nanomaterials — Preparation of safety data sheets (SDS)

## 1 Scope

This document provides guidance on the development of content for, and consistency in, the communication of information on safety, health and environmental matters in safety data sheets (SDS) for substances classified as manufactured nanomaterials (and materials or products that contain manufactured nanomaterials). It provides additional information on safety issues associated with manufactured nanomaterials. It provides supplemental guidance to ISO 11014:2009[1] on the preparation of SDSs.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/FDIS 80004-1, *Nanotechnologies – Vocabulary – Part 1: Core vocabulary*

*Globally harmonized system of classification and labelling of chemicals (GHS)*. United Nations Economic Commission for Europe, Fourth Edition, 2011

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/FDIS 80004-1, GHS :2011 and the following apply.

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/>

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### 3.1 <https://standards.iteh.ai/catalog/standards/iso/37831e03-751b-426d-8329-88aa00977d63/iso-dts-13329>

#### agglomerate

collection of weakly bound particles or aggregates or mixtures of the two where the resulting external surface area is similar to the sum of the surface areas of the individual components

Note 1 to entry: The forces holding an agglomerate together are weak forces, for example van der Waals forces, or simple physical entanglement.

Note 2 to entry: Agglomerates are also termed secondary particles and the original source particles are termed primary particles.

[SOURCE: ISO 80004-1:2023, 3.2.4]

### 3.2

#### aggregate

particle comprising strongly bonded or fused particles where the resulting external surface area is significantly smaller than the sum of surface areas of the individual components

Note 1 to entry: The forces holding an aggregate together are strong forces, for example covalent bonds, or those resulting from sintering or complex physical entanglement.

Note 2 to entry: Aggregates are also termed secondary particles and the original source particles are termed primary particles.

**ISO/DTS 13329:(en)**

[SOURCE: ISO/~~FDIS~~ 80004-1:2023, 3.2.5]

**3.3**

**bioaccumulation**

process of accumulation of a substance in organisms or parts thereof

[SOURCE: ISO 6107-6:2004, ~~definition 10~~:2021, 3.64]

**3.4**

**biodurability**

physicochemical property which depends on dissolution and leaching as well as mechanical breaking and splitting of a material in a physiological solution such as a Gamble solution

Note 1 to entry: The biodurability test is usually performed *in vitro*.

**3.5**

**biopersistence**

ability of a material to persist in a tissue in spite of the tissue's physiological clearance mechanisms and environmental conditions

[EU R 18748:1999]

[SOURCE: EUR 18748:1999, 1.2, modified — The word "fibre" has been removed and the word "lung" replaced by "tissue".]

**3.6**

**biodegradability**

susceptibility of an organic substance to biodegradation

[SOURCE: ISO 6107:2021, 3.68]

**3.7**

**chemical product**

substance or mixture

ISO/DTS 13329

[SOURCE: ISO 11014:2009, ~~definition~~-3.1]

**3.8**

**crystallinity**

presence of three-dimensional order at the level of molecular dimensions

[SOURCE: ISO 472:~~1999~~2013, 2.240]

**3.9**

**dustiness**

propensity of ~~a material~~materials to ~~generate~~produce airborne dust during ~~their~~ handling

[Note 1 to entry: Dustiness is not an intrinsic property as it depends on how it is measured.]

[SOURCE: EN ~~15051:2006~~1540:2021, 3.1.2.9]

**3.10**

**engineered nanomaterial**

nanomaterial designed for a specific purpose or function

[SOURCE: ISO 80004-1,~~def.~~2023, 3.1.8]



**3.11**

**hazard class**

nature of the physical, health or environmental hazard as used in GHS

~~[GHS:2001]~~

~~[SOURCE: GHS:2011, Chapter 1.2, modified — Examples removed from definition and "as used in GHS" added.]~~

**3.12**

**hazard statement**

statement assigned to a hazard class and category as used in GHS that describes the nature of the hazards of a hazardous substance or mixture, including, where appropriate, the degree of hazard

~~[SOURCE: ISO 11014:2009, definition-3.6], modified — "Hazardous product" replaced with "hazardous substance or mixture" and "as used in GHS" added.]~~

**3.13**

**incidental nanomaterial**

nanomaterial generated as an unintentional by-product of a process

Note 1 to entry: The process includes manufacturing, biotechnological or other processes, including natural processes.

Note 2 to entry: Used as a synonym for "ultrafine particle" in ISO/TR 27628:2007.

~~[SOURCE: ISO 80004-1, def. 2023, 3.1.10]~~

**3.14**

**manufactured nanomaterial**

nanomaterial intentionally produced to have specific properties or specific composition

~~[ISO 80004-1, def. 3.1.9]~~

~~[SOURCE: ISO 80004-1:2023, 3.1.9, modified — "Selected properties or composition" replaced with "specific properties or specific composition".]~~

**3.15**

**mixture**

mixture or solution composed of two or more substances in which they do not react

~~[SOURCE: GHS:2001, Chapter 1.2]~~

**3.16**

**nanofibre**

nano-object with two similar external dimensions in the nanoscale and the third dimension significantly larger

Note 1 to entry: The largest external dimension is not necessarily in the nanoscale.

~~[SOURCE: ISO 80004-1, def. 2023, 3.8.3.5]~~

**3.17**

**nanomaterial**

material with any external dimension in the nanoscale or having internal structure or surface structure in the nanoscale

Note 1 to entry: This generic term is inclusive of nano-object and nanostructured material.

**ISO/DTS 13329:(en)**

Note 2 to entry: See also engineered nanomaterial, manufactured nanomaterial and incidental nanomaterial.

[SOURCE: ISO 80004-1, def:2023, 3.1.4], modified — Notes to entry have been changed.]

**3.18**

**nano-object**

discrete piece of material with one, two or three external dimensions in the nanoscale

[SOURCE: ISO 80004-1, def:2023, 3.1.5]

**3.19**

**nanoparticle**

nano-object with all three external dimensions in the nanoscale

Note 1 to entry: If the dimensions differ significantly (typically by more than three times), terms such as nanofibre or nanoplate are preferred to the term nanoparticle.

[SOURCE: ISO 80004-1, def:2023, 3.3.4]

**3.20**

**nanoplate**

~~nano-object with one external dimension in the nanoscale and the two other external dimensions significantly larger~~

Note to entry: The larger external dimensions are not necessarily in the nanoscale.

[ISO 80004-1, def:3.3.6]

**3.21**

**nanopowder**

particulate material only composed of nano-objects

Note 1 to entry: Nanopowder can include *agglomerates* (3.4) and/or *aggregates* (3.2) in the nanoscale (3.21) (largest dimension ≤ 100 nm).

[SOURCE: ISO 18451-1:2019, 3.85]

**3.221**

**nanoscale**

length range approximately from 1 nm to 100 nm

[SOURCE: ISO 80004-1, def:2023, 3.1.1]

**3.232**

**nanostructure**

surface or internal feature with one or more dimensions in the nanoscale

Note 1 to entry: A feature includes but is not limited to nano-objects, structures, morphologies or other identifiable areas of nanoscale dimensions. For example, the nanostructure can be a nanopore or a solid feature on an object.

[SOURCE: ISO 80004-1, def:2023, 3.1.6]

**3.2423**

**nanostuctured material**

material having internal nanostructure or surface nanostructure

## ISO/DTS 13329:(en)

Note 1 to entry: This definition does not exclude the possibility for a nano-object to have internal structure or surface structure. If external dimensions are in the nanoscale, the term nano-object is recommended.

[SOURCE: ISO 80004-1, ~~def:2023~~, 3.1.7]

### 3.2524

#### **particle**

minute piece of matter with defined physical boundaries

Note 1 to entry: A physical boundary can also be described as an interface.

Note 2 to entry: This general particle definition applies to nano-objects.

[SOURCE: ISO 26824, ~~def:2022~~, 3.1.1, modified] — A note to entry has been deleted.]

### 3.2625

#### **primary particle**

original source particle of agglomerates or aggregates or mixtures of the two

Note 1 to entry: *Constituent particles* of agglomerates or aggregates at a certain actual state can be primary particles, but often the constituents are aggregates.

Note 2 to entry: Agglomerates and aggregates are also termed secondary particles.

[SOURCE: ISO 26824:2022, 3.1.4]

### 3.2726

#### **safety data sheet**

#### **SDS**

document specifying the properties of a substance, its potential hazardous effects for humans and the environment, and the precautions necessary to handle and dispose of the substance safely

[SOURCE: ISO 11139:2018(en), 3.239]

### 3.2827

#### **substance**

chemical elements and their compounds in the natural state or obtained by any production process, including any additive necessary to preserve the stability of the product and any impurities deriving from the process used, but excluding any solvent which can be separated without affecting the stability of the substance or changing its composition

[SOURCE: GHS:20042011, Chapter 1.2]

### 3.2928

#### **surface area**

area of the external surface of a solid plus the internal surface of its accessible macro-, meso- and micropores

[SOURCE: ISO 9277:2022, 3.10]

## **4 SDS preparation**

### **4.1 General**

~~It is advised to prepare a~~ **4.1.1 An SDS should be prepared** for all manufactured nanomaterials, regardless of whether or not the bulk (non-nanoscale) material is classified as hazardous, except when: