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BSI Standards Publication

Nanotechnologies - Guidelines for the management and disposal of waste from the manufacturing and processing of manufactured nano-objects

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National foreword

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A list of organizations represented on this committee can be obtained on request to its secretary.

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English Version

Nanotechnologies - Guidelines for the management and disposal of waste from the manufacturing and processing of manufactured nano-objects

Nanotechnologies - Lignes directrices pour la gestion et l'élimination des déchets issus de la fabrication et la transformation des nano-objets manufacturés

Nanotechnologien - Leitfaden für die Handhabung und Entsorgung des Abfalls von hergestellten und verarbeiteten Nano-Objekten

This Technical Specification (CEN/TS) was approved by CEN on 28 September 2018 for provisional application.

The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

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European foreword

This document (CEN/TS 17275:2018) has been prepared by Technical Committee CEN/TC 352 “Nanotechnologies”, the secretariat of which is held by AFNOR.

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Introduction

Innovation in nanotechnology is linked with commercial developments that use nanomaterials to deliver new products or services to the market. In recent years, nanotechnology has moved from the research laboratory to the manufacturing plant and into consumer products. Manufactured nano-objects (MNOs) can be incorporated in products to enhance their performance and create new properties. In the process of making such products, using them or disposing them at the end of their life, MNOs may be released and come in contact with humans and the environment. As of yet, MNO producers and the scientific community do not have a complete understanding of whether nanomaterials, particularly MNOs pose a risk to the health of workers, consumers and the environment. It is thought that some MNOs may pose a hazard to human health and the environment.

Nanomaterials include nano-objects and nanostructured materials. Nano-objects may be naturally occurring, incidental [CEN ISO/TS 80004-1:2015, 2.10], engineered or manufactured [CEN ISO/TS 80004-1:2015, 2.9]. In general, naturally occurring and incidental nano-objects are emitted into the atmosphere by natural process or as a by-product of a process (for example welding fume, combustion fume). Engineered nano-objects (ENOs) or MNOs, a very specific class of nanomaterials, are sometimes incorporated in products to achieve new or enhanced / improved properties, which are only attainable with nanotechnology. In some cases, they may be substituted for highly toxic substances, may lead to waste reduction, or may extend the longevity of a product.

MNOs may have distinct physicochemical properties as a result of their nanoscale formulation. Thus, they may exhibit hazards and risks to human health and to the environment distinct from those presented by non-nanoscale materials. There is therefore a need for specific guidance on the assessment and management of the human health and environmental hazards and risks associated with the management and disposal of waste from the manufacturing and processing of manufactured nano-objects (WMP-MNOs).

The manufacturing of MNOs and their incorporation in products may involve multi-stage processes, including primary synthesis, precipitation, sorting, chemical or physical separation and purification, as well as incorporation in intermediate products.

Each process in the manufacturing chain may generate process wastes, residues and diffuse release of MNOs or their aggregates and agglomerates. Process wastes may result from:

— making more or buying more than necessary (for example overproduction, large batches or excess items that remain in stock);

— making batches that are not at the correct specification or requirements of the customer; and

— making batches with expired specifications or requirements.

Diffuse release means the (unintended) release of chemicals to air, groundwater and soil, which occur in a diffuse way due to processes such as migration or dispersing, and which should be avoided. Diffuse emissions can be controlled via, for example, waste collection and adequate waste treatment, where MNOs will be either eliminated or accumulated in a controlled system.

In general, WMP-MNOs are expected to be in a powder form, in a liquid suspension and /or contaminated items. Nano-objects resulting from the manufacturing and processing of MNOs can be classified in two categories:

— nano-objects having the same physical and chemical identity as the final intended nano-object production batch, which are generated during manufacturing and processing;

— nano-objects being production residues or being the result of a non-conformed batch production (production refuse). Their physico-chemical characteristics may be known, partially known or unknown due to unintended transformation processes.

Powder-form and liquid WMP-MNOs can be composed purely of nano-objects and non-nanoscale particles.

The industry involved in nanotechnology and nanomaterials is a linear network as illustrated in Figure 1. It involves organizations ranging from raw material producers (suppliers of MNOs), modifiers (producers of semi-products obtained by modifying the composition or the surface of MNOs), to formulators and users of nanomaterials (who incorporate MNOs or semi-products in finished products, resulting in nanostructured materials or nanocomposites).

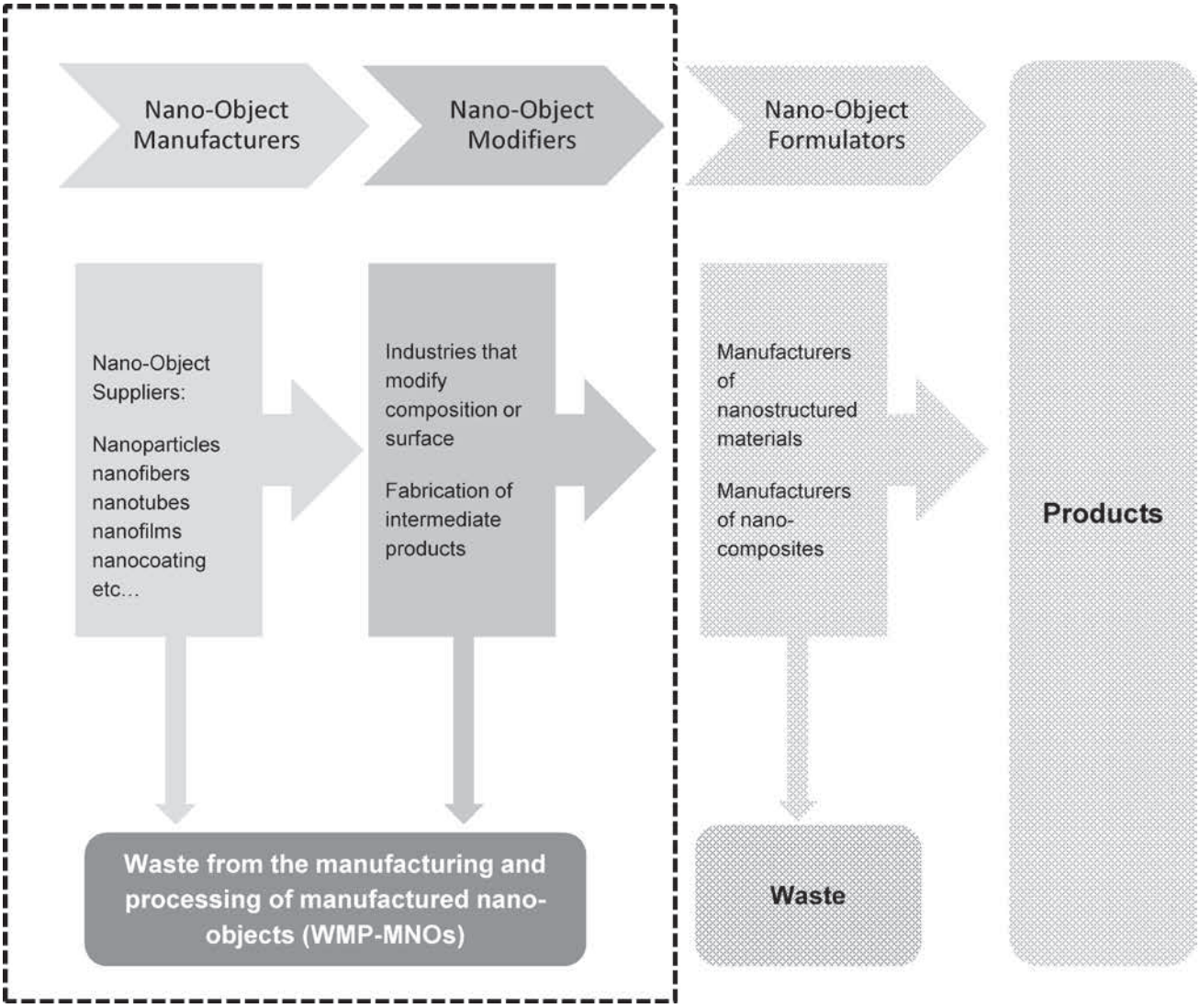

Figure 1 — Overview of the nanotechnology and nanomaterials industry

Disposal routes for non-nanoscale materials are well known and well-regulated in all EU member states by national and the EU directives. It is not the intention of this document to lead on this. This document serves as a guideline to the safe waste management of WMP-MNOs and provides guidelines for all waste management activities from the manufacturing and processing of MNOs as illustrated in Figure 1 by the dotted lines.

This Technical Specification (TS) aims to provide guidance for all waste management activities associated with the manufacturing and processing of MNOs including the management of process waste, residues and diffuse emissions of MNOs and takes into account the uncertainties in this emerging technology and the potential for human and environmental exposure.

1 Scope

This document provides guidelines for all waste management activities from the manufacturing and processing of manufactured nano-objects.

The guidelines apply to all actors in the waste management chain, namely MNO manufacturers, MNO modifiers, as well as waste disposal companies and carriers and consignees of WMP-MNOs.

This document does not intend to provide guidelines on the management and disposal of nanocomposites, waste derived from consumer products containing nano-objects or waste containing only naturally occurring or incidental nano-objects. Also excluded from the scope are any waste from non-nanoscale materials resulting from the manufacturing and processing of MNOs.

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.

EN 12457-1:2002, *Characterisation of waste — Leaching — Compliance test for leaching of granular waste materials and sludges — Part 1: One stage batch test at a liquid to solid ratio of 2 l/kg for materials with high solid content and with particle size below 4 mm (without or with size reduction)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1 Nanotechnologies general terms

3.1.1
engineered nano-object
nano-object (3.1.6) designed for specific purpose or function

[SOURCE: CEN ISO/TS 80004-2:2017, 4.1]

3.1.2
incidental nano-object
nano-object (3.1.6) generated as an unintentional by-product of a process

NOTE The process includes manufacturing, biotechnological or other processes.

[SOURCE: CEN ISO/TS 80004-2:2017, 4.3]

3.1.3
manufactured nano-object
nano-object (3.1.6) intentionally produced to have selected properties or composition

[SOURCE: CEN ISO/TS 80004-2:2017, 4.2]