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Nanotechnologies - Requirements and recommendations for the identification of measurands that characterise nano-objects and materials that contain them (ISO/TS 23302:2021)

Nanotechnologies - Exigences et recommandations pour l'identification des mesurandes qui caractérisent les nano-objets et les matériaux les contenant (ISO/TS 23302:2021)

Nanotechnologien - Anforderungen und Empfehlungen zur Identifizierung von Messgrößen zur Charakterisierung von Nanoobjekten und von Werkstoffen, die welche enthalten (ISO/TS 23302:2021)

This Technical Specification (CEN/TS) was approved by CEN on 5 September 2022 for provisional application.

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European foreword

The text of ISO/TS 23302:2021 has been prepared by Technical Committee ISO/TC 299 "Nanotechnologies" of the International Organization for Standardization (ISO) and has been taken over as CEN ISO/TS 23302:2022 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 23302:2021 has been approved by CEN as CEN ISO/TS 23302:2022 without any modification.

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Foreword

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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).

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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 by Technical Committee ISO/TC 229, *Nanotechnologies*, and IEC/TC 113, *Nanotechnology for electrotechnical products and systems*.

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

The term “nano-object” applies to materials having one, two or three external dimensions in the nanoscale (therefore in the range of approximately 1 nm to 100 nm). Specific size dependent properties are usually exhibited in this size range, even if they do not disappear abruptly beyond these limits. Nano-objects, either natural or manufactured, can be found in the form of nanoplates (one dimension in the nanoscale), nanofibres (two dimensions, or the diameter, in the nanoscale), and nanoparticles (three dimensions in the nanoscale). Nano-objects exhibit higher specific surface areas than larger objects. They are particularly prone to aggregation and agglomeration phenomena due to attractive interactions during their life cycle.

There is increasing use of nano-objects in research and development, industry and commercial applications. Characterization of nano-objects, and their agglomerates and aggregates (NOAAs) plays an essential role in basic and applied research, through process and product quality control and commercialization to health and environmental protection. Characterization of nano-objects is key to determine their physical and chemical properties, performance and lifetime. The methods available for characterization of larger scale materials are often difficult to apply to nano-objects, sometimes due to restrictions of the test systems (e.g. low sensitivity, inadequate resolution of equipment). This has resulted in the development of new techniques and adaptation of existing ones.

The method selection is often strongly influenced by its initial cost and availability, time and sample compatibility. However, an aspect that is easily forgotten is whether the selected method truly targets the physical or chemical material property that is intended to be measured (“the measurand”). This can sound trivial, but in practice, insufficient knowledge or consideration about the actual measurement principle and/or the property measured can impede a correct assessment of the measurement results.

Measurement techniques and methods are typically classified according to the material properties they can measure. One definition of “measurand” used in many ISO standards is the “quantity intended to be measured”. In nanotechnologies popular material properties often considered as this “intended measurand” can be size, shape, chemical composition, surface charge. However, in reality, due to their different underlying physical measurement principles, results obtained by different techniques, for a common material property, can differ significantly. The logical reason for this is that these different techniques measure not the intended measurand but different measurands, which are specific to the technique but are closely related to the intended measurand.

For intended use in biological systems and therapeutic purposes, additional characterization beyond those mentioned in the document may be required.

This document describes measurands used to characterize nano-objects, and their agglomerates and aggregates. This document is split into 10 main clauses covering:

— Clause 6: size and shape measurands;

— Clause 7: chemical analysis measurands;

— Clause 8: mass and density;

— Clause 9: charge measurands;

— Clause 10: crystallinity measurands;

— Clause 11: optical properties measurands;

— Clause 12: electrical and electronic measurands;

— Clause 13: magnetic measurands;

— Clause 14: thermal measurands;

— Clause 15: other performance related measurands.

Nanotechnologies — Requirements and recommendations for the identification of measurands that characterise nano-objects and materials that contain them

1 Scope

This document specifies requirements and recommendations for the identification of measurands to characterize nano-objects and their agglomerates and aggregates, and to assess specific properties relevant to the performance of materials that contain them. It provides recommendations for relevant measurement.

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 20579-4, *Surface chemical analysis — Guidelines to sample handling, preparation and mounting — Part 4: Reporting information related to the history, preparation, handling and mounting of nano-objects prior to surface analysis*

ISO/TS 80004-1:2015, *Nanotechnologies — Vocabulary — Part 1: Core terms*

ISO/TS 80004-2:2015, *Nanotechnologies — Vocabulary — Part 2: Nano-objects*

ISO/TS 80004-6:2021, *Nanotechnologies — Vocabulary — Part 6: Nano-object characterization*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/TS 80004-1:2015, ISO/TS 80004-2:2015 and ISO/TS 80004-6:2021 and the following apply.

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

— IEC Electropedia: available at https://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1 General core terms

3.1.1
nanoscale
length range approximately from 1 nm to 100 nm

Note 1 to entry: Properties that are not extrapolations from a larger size are predominately exhibited in this length range.

[SOURCE: ISO/TS 80004-1:2015, 2.1]