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*Open Innovation Test Beds for Lightweight, nano-enabled multifunctional composite materials and components (IA)*

## OASIS

**Open Access Single entry point for scale-up of Innovative Smart lightweight composite materials and components**

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**Report on the standardisation landscape and applicable standards**

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## OASIS

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## Executive Summary

This document is a report on the standardisation landscape and applicable standards relevant to the OASIS project. The OASIS project aims at fulfilling market potential of nano-enabled multifunctional lightweight products by:

- Gathering the manufacturing capacity of 12 pilot lines from nanoparticles to final product.
- Establishing a thorough service offer for associated technical & business development
- Granting direct access to the whole ecosystem through a Single Entry Point, for easier access especially for SMEs.

Oriented towards enhanced polymermatrix composites and aluminium, the pilot lines cover the whole manufacturing chain from nanoscale structures in unprocessed form, to intermediate products with nanoscale features and finally nano-enabled products. So, as to provide full support to interested companies, the new “Open Innovation Test Bed” will also offer complementary technical (modelling, characterization, toxicology, life cycle assessment) and non-technical services (business innovation coaching, business planning, access to private capital).

These modular services will be provided to companies, particularly to SMEs, to gain access to unique facilities and knowledge without high capital investment. Such support is particularly needed at the crossroads between three KETs (nanotechnologies, advanced materials and advanced manufacturing and processes) and in an era of multifunctional products when wide scope of know-how is needed for pre-production or industrial low-medium volume production.

This document is part of the works of T7.5, standardisation activities, of WP7, Dissemination, clustering and exploitation, of the OASIS project. The aim of this report is to provide an initial analysis of the standardisation landscape relevant for the project. This document has been produced with the objective of being a useful document to the stakeholders involved in OASIS, and as a first step towards the development of the following tasks:

- Development of a guide document that will ease the Test Bed users to identify the relevant standardisation environment and the relevant knowledge and contacts to start the process to standardise their innovative products.
- Contribution to the ongoing and future standardisation developments.

The OASIS project identified at its Kick-off meeting the development of a Guideline for a Sustainable Manufacturing Framework as an appropriate potential future standardisation development under the leadership of OASIS. Therefore, this search for the relevant standardisation landscape is mainly oriented to contribute to tasks T1.1 of OASIS, i.e. definition of the OASIS Sustainable Manufacturing Framework (SMF), and is focused on key relevant and applicable standards for the field of nanotechnology, avoiding the production of massive lists of documents not fully aimed to nano-manufacturing.

This document starts with a short introduction to standardisation, helping to understand what it is and how it works. It identifies the key players at International and European level and provides information on the different kinds of standardisation deliverables, as well as practical information regarding its coding. Useful information on the abbreviations and acronyms commonly used in standardisation is also given.

The core of the document is divided into two main areas:

- Identification of the relevant standardisation technical bodies developing standards relevant to nanotechnologies (subclause 2.3) and of its main documents (subclause 2.5).
- Identification of the relevant standardisation technical bodies developing standards relevant to a sustainable manufacturing framework (subclause 2.4) and of its main documents (subclause 2.6).

A key trigger for the European standardisation on nanotechnologies was the European Commission Mandate (current standardisation requests) M/461 for standardisation activities regarding nanotechnologies and nanomaterials. This is the reason why the standards currently developed and being developed under M/461 are referenced in this report, as well as the European technical bodies involved.

The document identifies 4 key European and International technical bodies directly focusing on the development of standards relevant to nanotechnologies. Those are:

- CEN/TC 352, Nanotechnologies, and ISO/TC 229, Nanotechnologies, covering the non-electrotechnical aspects of nanotechnologies
- CLC/SR 113, Nanotechnology standardization for electrical and electronics products and systems, and IEC/TC 113, Nanotechnology for electrotechnical products and systems, covering the electrotechnical aspects of nanotechnologies

The documents of CEN/TC 352 and ISO/TC 229 are the most significant ones on its field, and are structured in this document under the following criteria:

- General documents, including terminology and nomenclature, material specifications and products and applications
- Measurement, characterization and performance evaluation, with a separate list of those documents on Carbon Nano Tubes (CNT)
- Sustainability, consumer and societal dimensions
- Health, safety and environmental aspects, with a separate list of those documents on nano-objects and their aggregates and agglomerates (NOOA)

Other European technical bodies have been identified focused on nanotechnologies. However, only CEN/WS MODA, Materials modelling, terminology, classification and metadata had developed a new standardisation deliverable on this field when this document was drafted: CWA 17284, on computational material modelling and simulation.

CEN/TC 137, Assessment of workplace exposure to chemical and biological agents, and CEN/TC 195, Air filters for general air cleaning, are the two European standardisation technical bodies apart from CEN/TC 352 developing standards under M/461. However, most of their work is not focused on nanotechnologies. Due to this, its documents have been classified in 2 categories: those that are directly related to M/461 and to nanotechnologies and those that are not.

Other European standardisation technical bodies are not focused on nanotechnologies, but develop documents related to them. Documents from CEN/248/WG 26, Textiles -Test methods for analysis of EC restricted substances, CEN/TC 264, Air quality, CEN/TC 298, Pigments and extenders, CEN/TC 430, Nuclear energy, nuclear technologies, and radiological protection, CEN/TC 459/SC 1, Test methods for steel (other than chemical analysis), CLC/SR 47F, Micro-electromechanical systems and, CLC/SR 68, Magnetic alloys and steels, have been identified under this category.

This document focuses in the formal International and European standardisation system. However, reference is made to the works of the technical Committee E56 on Nanotechnology of ASTM International and of the American Concrete Institute, ACI.

On sustainability, besides the works of CEN/TC 352, ISO/TC 229, CEN/TC 137 and CEN/TC 195, there is a high number of technical bodies developing standards that can help to shape an OASIS sustainable manufacturing framework. They have been classified according to the following criteria:

- General standardisation works relevant to sustainability. Some works of ISO/TMBG (ISO Guide 82), CEN/WS 072, Framework for SustainValue - Sustainable Value Creation in manufacturing networks, ISO/TC 127, Earth-moving machinery, CEN/TC 350, Sustainability of construction works, ISO/TC 59/SC 17, Sustainability in buildings and civil engineering works, Technical Committee E60.13 on Sustainable Manufacturing of ASTM International and of the OECD (OECD Sustainable Manufacturing Toolkit) have been identified relevant to this category.
- Standardisation works focused on the social aspect of sustainability, with a special focus on occupational health and safety. Some works of ISO/TMBG (ISO 26000 on Social Responsibility, ISO 20400 on Sustainable procurement), ISO/TC 283, Occupational health and safety management, ISO/TC 262, Risk management, CEN/TC 114 and ISO/TC 199, Safety of machinery, CEN/TC 122, Ergonomics, and of ISO/TC 159/SC 3, Anthropometry and biomechanics, have been identified relevant to this category.
- Standardisation works focused on the environmental aspect of sustainability. Some works of ISO/TC 207, Environmental management, have been identified relevant to this category.
- Standardisation works focused on the economic aspect of sustainability. Some works of ISO/TC 176/SC 2, Quality systems, and of the Spanish standards body, UNE, have been identified relevant to this category.

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## 1. Content of Deliverable

The structure of this document is the following:

- 1) Introduction on the European and International standardisation system
- 2) Identification of the relevant standardisation fields (organisations and technical bodies) relevant to nanotechnologies
- 3) Identification of the relevant standardisation fields (organisations and technical bodies) relevant to a sustainable manufacturing framework
- 4) Identification of the main standards relevant to nanotechnologies produced by the organisations and technical bodies referenced previously
- 5) Identification of the main standards relevant to a sustainable manufacturing framework produced by the organisations and technical bodies referenced previously
- 6) Conclusions

The scope and structure of the different relevant technical bodies are described and, when relevant, links to their official web sites are given. 17 technical bodies have been identified as directly relevant to nanotechnologies. The works of 16 technical bodies have been identified as relevant to shape a sustainable manufacturing framework.

On the standardisation documents identified, its reference, title, drafting body and status (published or under development) are provided. In order to help to assess its relevance to the project, the scope of each of the documents is also given, except for those document that have been identified as not relevant to nanotechnologies nor to sustainable manufacturing, or for those documents whose scope is not available (e.g. those in early stages of development). 370 standardisation deliverables have been identified as directly relevant to nanotechnologies, including published standards and documents under development. 45 standardisation deliverables have been identified as key reference documents for a sustainable manufacturing framework.

## 2. Results and Discussion

### 2.1. Focus on sustainable nanomanufacturing

The initial methodology planned for the development of this deliverable was the following:

- Define the fields of interest: Propose different standardisation fields and collect the feedback of partners on this.
- Determine the related standards and standardization committees: Propose a relation of different standards and standardisation committees and collect the feedback of partners on this.

However, it was clear from the kick-off meeting that the search for the relevant standardisation landscape was mainly relevant to tasks T1.1, definition of the OASIS Sustainable Manufacturing Framework (SMF) led by TEC, and T6.1, verification of the level of implementation of the OASIS-SMF, led by CEA and TEC. This is due to the following facts:

- The Sustainable Manufacturing Framework is to be industry-oriented and, therefore, should be supported and based on standards, as standards are the language of the industry.
- The Sustainable Manufacturing Framework will be the base for the Pilot Lines.
- Nearly any nano-product could be produced in the Pilot Lines of OASIS, and D.7.12, Guides for the use of standardisation by Test Bed users, will provide information relevant for the potential users.
- The goal was to produce a useful document that would point the really relevant and applicable standards for the field of OASIS, instead of a massive list of documents not fully aimed to nano manufacturing.
- The OASIS proposal identified at the Kick-off meeting for the potential contribution to standardisation was the development of a Guideline for a Sustainable Manufacturing Framework. In fact, a close relationship relevant to T1.1 was established between TEC, CEA and UNE since the Kick-off meeting.

All these reasons motivated a change in the methodology for the development of this deliverable, and UNE integrated in the drafting team of D1.1, OASIS Sustainable Manufacturing Framework, that has worked by correspondence and also met the following dates:

- 2019-03-07 (face-to-face meeting)
- 2019-03-28 (virtual meeting)
- 2019-04-25 (virtual meeting)
- 2019-05-28 (virtual meeting)
- 2019-06-18+19 (face-to-face meeting)

In these meetings UNE has dialogued and has collected the feedback of TEC, CEA and SIS. These contributions have been a key factor to define the scope and approach of this document.



## 2.2. Short introduction about standardisation

### 2.2.1. The standardisation system

A standard is an agreed definition or specification of a unit, method, product, process or service, voluntary in its application, developed by consensus in a standardization body and made publicly available.

Standards provide people and organizations with a basis for mutual understanding and are used as tools to facilitate communication, measurement, commerce and manufacturing. The initiative to develop a standard is taken by interested stakeholders who consider that a particular standard could address specific needs.

Standards are everywhere and play an important role in the economy, by:

- facilitating business interaction, market development and eliminating barriers
- enabling companies to comply with relevant standards, laws and regulations
- speeding up the introduction of innovative products to market
- providing interoperability between new and existing products, services and processes.

Standards form the basis for the introduction of new technologies and innovations, and ensure that products, components and services supplied by different companies will be mutually compatible.

Standards also disseminate knowledge in industries where products and processes supplied by various providers must interact with one another. Standardization is a voluntary cooperation among industry, consumers, public authorities, researchers and other interested parties for the development of technical specifications based on consensus.

Standardization is identified in FP7 and Horizon 2020 as one of the innovation-support measures by bridging the gap between research and the market, and helping the fast and easy transfer of research results to the European and international market.

Standards are voluntary technical documents. They are developed and defined through a process of sharing knowledge and building consensus among technical experts nominated by interested parties and other stakeholders - including businesses, consumers and environmental groups, among others. These experts are organized in Technical Committees (TCs), which are subdivided in Subcommittees (SCs) or Working Groups (WGs). These TCs are included in the structure of the Standardization Organizations (National, European and International, with the respective mirror committees) and work following their internal regulations.

The standardization bodies operate at National (AENOR, AFNOR, BSI, DIN, etc.), Regional - in our case European - (CEN, CENELEC, ETSI) or International (ISO, IEC, ITU) level. Sometimes there are different standardization bodies at the same level, but covering different fields. This is the case of ISO (general), IEC (electrical) and ITU (telecommunications) at International level, or CEN, CENELEC and ETSI at European level in the same way.

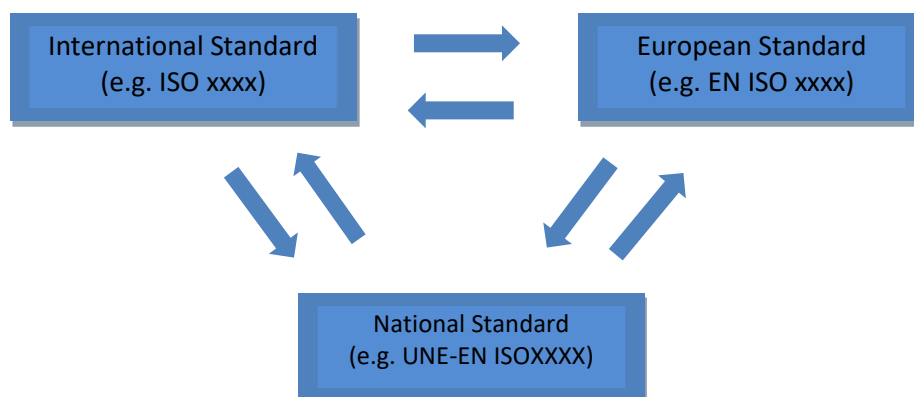
There are also different kinds of standardization documents. The most widespread is the standard, which has a different code depending on the organization under it was developed. e.g. EN for European Standards, ISO for International standards. Other types of documents are Technical Specifications (TS), Technical Reports (TR) and Workshop Agreements (CWA). Further Amendments to the standards are identified by adding A1, A2, etc. at the end of the standard code.

At European level, all the members of CEN shall adopt EN standards as national standards and must withdraw any existing national standard which could conflict with them. A summary of the characteristics of the different standardization documents can be found in table 1.

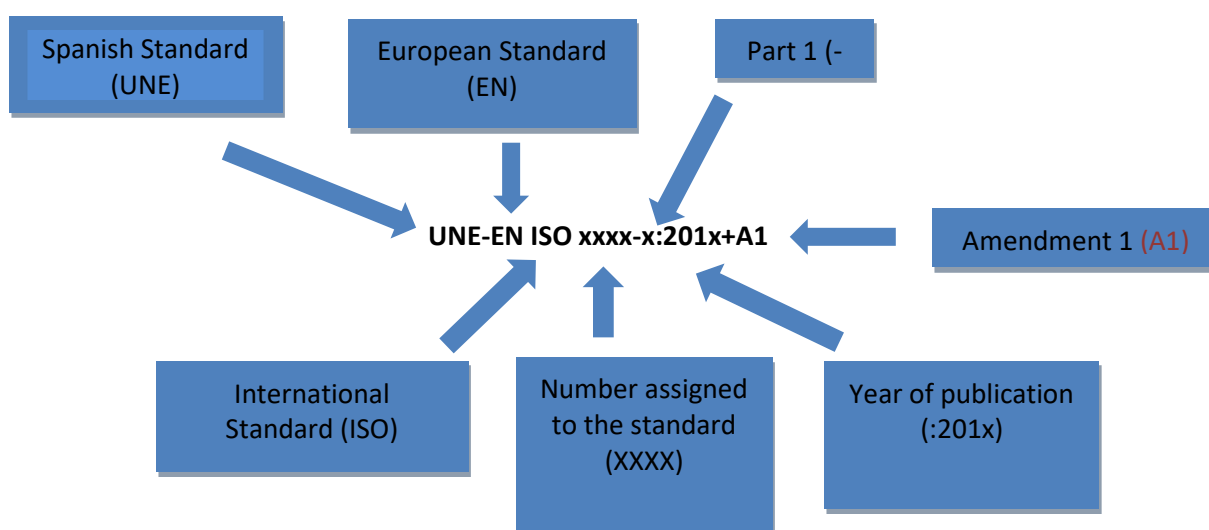
**Table 1 – Characteristics of different standardization documents**

Type	International code	European code	National code	Main characteristics
<b>Standard</b>	ISO IEC	EN	UNE, NF, BS, DIN, etc.  When adopting: UNE-EN, NF-EN, UNE-ISO, NF-ISO, etc.	<ul style="list-style-type: none"> <li>• Elaboration: 3 years</li> <li>• 2 steps of member approval (can be reduced to only 1 step in certain situations)</li> <li>• European: compulsory national adoption</li> <li>• Revision: every 5 years</li> </ul>
<b>Technical Specification</b>	ISO/TS IEC/TS	CEN/TS CLC/TS	When adopting: UNE-CEN/TS, NF-CEN/TS, UNE-ISO/TS, NF-ISO/TS, etc	<ul style="list-style-type: none"> <li>• Elaboration: 21 months</li> <li>• 1 step of member approval or internal approval in TC</li> <li>• European: optional national adoption</li> <li>• Revision: after 3 years (upgrading to EN or deletion)</li> </ul>
<b>Technical Report</b>	ISO/TR IEC/TR	CEN/TR CLC/TR	When adopting: UNE-CEN/TR, NF-CEN/TR, UNE-ISO/TR, NF-ISO/TR, etc	<ul style="list-style-type: none"> <li>• Elaboration: free timeframe</li> <li>• Internal approval in TC</li> <li>• European: optional national adoption</li> <li>• No revision required</li> </ul>
<b>Workshop Agreement</b>	IWA	CWA	Variable	<ul style="list-style-type: none"> <li>• Elaboration: free timeframe (usually few months)</li> <li>• Internal approval in the Workshop</li> <li>• European: optional national adoption</li> <li>• Revision: after 3 years (upgrading to EN or deletion)</li> </ul>

There is also an agreement established between European and International Organizations (e.g. CEN and ISO) in order to avoid duplication of efforts and promote global relevance of standards, which allows to adopt or develop in parallel each other's standards with the same content and code. National standards could also be proposed as a base for new European or International standards. The following figure 1 shows the possible tracks of the standards.

**Figure 1 – Possible tracks of standards adoption**

Therefore, the code of any standard is the combination of the above mentioned issues, and could be explained as shown in figure 2.

**Figure 2 – Example of identification of elements in the code of a standard**

### 2.2.2. Abbreviations and acronyms

Useful abbreviations related to standardization are listed below:

#### Abbreviations: CEN/CLC

**CEN** European Committee for Standardization

**CENELEC (CLC)** European Committee for Electrotechnical Standardization

**BT** Technical Board

**EN** European Standard

**CWA** CEN Workshop agreement

#### Abbreviations: ISO/IEC

**ISO** International Organization for Standardization

**IEC** International Electrotechnical Commission

#### Technical management:

- **ISO** Technical Management Board (ISO/TMB)
- **IEC** Standardization Management Board (SMB)

#### Common abbreviations: ISO/IEC and CEN/CLC

**JTC** Joint Technical Committee

**JWG** Joint working group

**TC** Technical committee

**SC** Subcommittee

**PC** Project committee

**WI** Work item

**WG** Working group

**TS** Technical Specification

**TR** Technical Report

**WS** Workshop

### 2.3. Relevant standardization fields on nanotechnologies

Nanotechnologies are about the design, characterization, production, and application of structures, devices, and systems by controlling shape and size at the atomic scale. Nanomaterials are materials which often have specific properties due to their small particle size.

As ‘Key Enabling Technologies’, the design and use and application of nanotechnologies has an impact on all aspects of life and enable advances in areas of health, manufacturing, environment, industrial and consumer applications and knowledge-based technologies.

This subclause lists and describes the main standardisation technical bodies relevant to nanotechnologies.

The main documents produced by those technical bodies are listed in subclause 2.5, Relevant standardization documents on nanotechnologies, of this report.

#### 2.3.1. M/461 Mandate addressed to CEN, CENELEC and ETSI for standardization activities regarding nanotechnologies and nanomaterials

Due to the relevance of nanotechnologies, CEN accepted in 2007 the European Commission Mandate M/409 (Nanotechnologies) for the elaboration of a programme of standards to take into account the specific properties of nanotechnologies and nanomaterials. Based on the findings of M/409, CEN accepted in 2010 a new Mandate, M/461 (Nanotechnologies, Nanomaterials), for Standardization activities regarding Nanotechnologies and Nanomaterials. The core of M/461 is the development of standardisation deliverables relevant to the following areas:

- Characterisation of and exposure from nanomaterials
  - Methodologies for nanomaterial characterisation in the manufactured from and before toxicity and eco-toxicity testing
  - Sampling and measurement of workplace, consumer and environment exposure to Nanomaterials
  - Methods to simulate exposures to nanomaterials
- Health, safety and environment
  - Occupational handling and exposure
  - Guidance on safe handling of manufactured nanoparticles and other manufactured nanoscale entities (including selection of Personal Protective Equipment)
  - Guidance on containment, trapping and destruction of nanoparticles and other manufactured nanoscale entities
  - Guidance on dosimetry and exposure determination in occupational settings relevant to manufactured nanomaterials
  - Methodology to determine effectiveness of filtration media against nanomaterials
  - Standard method to assess emissions from handling, or machining of nanomaterials containing products

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- Protocols for determining the explosivity and flammability of nano-powders (for transport, handling and storage)
- Guidance on detection and identification of nanoparticles and other nanoscale entities (in all media types, including waste streams from manufacturing and manufacturing discharges)
- Protocols for the characterisation of manufactured nanoparticles from aerosols and from environmental sources, including sampling, sample stabilisation, agglomeration, aggregation, etc.
- Guide to the identification and definition of measurands required for characterising, evaluating functional properties and performance, etc of materials and devices at the nanoscales
- Product specifications for different manufactured nanomaterials
- Guide to basic morphology and purity of manufactured nanoparticles and other nanoscale entities
- Guide to purity evaluation of manufactured nanoparticles and other nanoscale entities
- Guide to modelling (measurement, simulation and visualisation) of the nanoscale
- Guide to the management of waste and the disposal of nanomaterials

CEN decided that CEN/TC 352, Nanotechnologies, should take the leadership for the coordination of the execution of M/461. CEN/TC 137, Assessment of workplace exposure to chemical and biological agents, and CEN/TC 195, Air filters for general air cleaning, are the two other CEN Technical Bodies developing standardisation deliverables that give an answer to M/461.

The standards currently developed and being developed under M/461 are the following:

Reference	Title	Standard Status	Drafting Body
EN 16897:2017	Workplace exposure - Characterization of ultrafine aerosols/nanoaerosols - Determination of number concentration using condensation particle counters	Published	CEN/TC 137/WG 3
EN 17058:2018	Workplace exposure - Assessment of exposure by inhalation of nano-objects and their aggregates and agglomerates	Published	CEN/TC 137/WG 3
CEN ISO/TS 21623:2018	Workplace exposure - Assessment of dermal exposure to nano-objects and their aggregates and agglomerates (NOAA) (ISO/TS 21623:2017)	Published	CEN/TC 137/WG 6 and ISO/TC 145/SC 2
EN 16966:2018	Workplace exposure - Measurement of exposure by inhalation of nano-objects and their aggregates and agglomerates - Metrics to be used such as number concentration, surface area concentration and mass concentration	Published	CEN/TC 137/WG 3
EN 17199-1:2019	Workplace exposure - Measurement of dustiness of bulk materials that contain or release respirable NOAA and other respirable particles - Part 1: Requirements and choice of test methods	Published	CEN/TC 137/WG 3

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Reference	Title	Standard Status	Drafting Body
EN 17199-2:2019	Workplace exposure - Measurement of dustiness of bulk materials that contain or release respirable NOAA or other respirable particles - Part 2: Rotating drum method	Published	CEN/TC 137/WG 3
EN 17199-3:2019	Workplace exposure - Measurement of dustiness of bulk materials that contain or release respirable NOAA or other respirable particles - Part 3: Continuous drop method	Published	CEN/TC 137/WG 3
EN 17199-5:2019	Workplace exposure - Measurement of dustiness of bulk materials that contain or release respirable NOAA or other respirable particles - Part 5: Vortex shaker method	Published	CEN/TC 137/WG 3
EN 17199-4:2019	Workplace exposure - Measurement of dustiness of bulk materials that contain or release respirable NOAA or other respirable particles - Part 4: Small rotating drum method	Published	CEN/TC 137/WG 3
EN ISO 21083-1:2018	Test method to measure the efficiency of air filtration media against spherical nanomaterials - Part 1: Size range from 20 nm to 500 nm (ISO 21083-1:2018)	Published	CEN/TC 195/WG 6 and ISO/TC 142
CEN ISO/TS 21083-2:2019	Test method to measure the efficiency of air filtration media against spherical nanomaterials - Part 2: Size range from 3 nm to 30 nm (ISO/TS 21083-2:2019)	Published	CEN/TC 195/WG 6 and ISO/TC 142
CEN/TS 17010:2016	Nanotechnologies - Guidance on measurands for characterising nano-objects and materials that contain them	Published	CEN/TC 352/WG 1
CEN/TS 17276:2018	Nanotechnologies - Guidelines for Life Cycle Assessment - Application of EN ISO 14044:2006 to Manufactured Nanomaterials	Published	CEN/TC 352/WG 3
CEN/TS 17273:2018	Nanotechnologies - Guidance on detection and identification of nano-objects in complex matrices	Published	CEN/TC 352/WG 3
CEN/TS 17274:2018	Nanotechnologies - Guidelines for determining protocols for the explosivity and flammability of powders containing nano-objects (for transport, handling and storage)	Published	CEN/TC 352/WG 3
CEN/TS 17275:2018	Nanotechnologies - Guidelines for the management and disposal of waste from the manufacturing and processing of manufactured nano-objects	Published	CEN/TC 352/WG 3
00352038	Nanotechnologies - Sampling for direct analysis (shape, size distribution, elemental composition)	Under development Under development	CEN/TC 352/WG 1

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Reference	Title	Standard Status	Drafting Body
00352040	Nanotechnologies - Quick start guide for deploying a relevant nano health and safety risk management	Under development	CEN/TC 352/WG 3
00352041	Nanotechnologies - Decision trees and flow charts towards sensible toxicity and ecotoxicity testing of engineered nanomaterials	Under development	CEN/TC 352/WG 3
00352043	Nanotechnologies - Guidance on the determination of aggregation and agglomeration state of nano-objects	Under development	CEN/TC 352/WG 1
00352044	Nanotechnologies - Guidelines for the characterization of nanoobjects-containing additives in food products	Under development	CEN/TC 352
00352045	Nanotechnologies - Challenges and capabilities to enhance the NOAA traceability in the B2B value chain for transparency and innovation purposes	Under development	CEN/TC 352
00352046	Risk Assessment and Life Cycle Assessment of Nanomaterials: Synergistic use of data for efficient and effective evaluations	Under development	CEN/TC 352
00352047	Safe-by-Design concept dedicated for nano scale materials (MNM) and products containing nanomaterials	Under development	CEN/TC 352/WG 2

### 2.3.2. Main European and International technical bodies developing standards focused on nanotechnologies

#### CEN/TC 352, Nanotechnologies

CEN/TC 352, Nanotechnologies<sup>1</sup>, is the European Technical Committee that drafts standardisation documents in the field of nanotechnologies, that includes either or both of the following:

- i. understanding and control of matter and processes at the nanoscale, typically, but not exclusively below 100 nanometres in one or more dimensions, where the onset of size dependent phenomena usually enables novel applications;
- ii. utilizing the properties of nanoscale materials that differ from the properties of individual atoms, molecules or bulk matter, to create improved materials, devices and systems that exploit these new properties.

Specific tasks include developing standards for: classification, terminology and nomenclature; metrology and instrumentation, including specifications for reference materials; test methodologies; modelling and simulation; science-based health, safety and environmental practices; and nanotechnology products and processes. Standards in each of these areas could be specific to a product, process or industry.

The structure of CEN/TC 352 is the following:

- CEN/TC 352/WG 1      Measurement, characterization and performance evaluation
- CEN/TC 352/WG 2      Commercial and other stakeholder aspects

<sup>1</sup> See [https://standards.cen.eu/dyn/www/f?p=204:7:0:::FSP\\_ORG\\_ID:508478&cs=1A6FDA13EC1F6859FD3F63B18B98492ED](https://standards.cen.eu/dyn/www/f?p=204:7:0:::FSP_ORG_ID:508478&cs=1A6FDA13EC1F6859FD3F63B18B98492ED)



- CEN/TC 352/WG 3 Health, safety and environmental aspects

### **ISO/TC 229, Nanotechnologies**

ISO/TC 229, Nanotechnologies<sup>2</sup>, is the International Technical Committee responsible of the standardization in the field of nanotechnologies. Its scope is the equal to the one of CEN/TC 352.

The structure of ISO/TC 229 is the following:

ISO/TC 229/CAG Chairman Advisory Group

- ISO/TC 229/JWG 1 Terminology and nomenclature
- ISO/TC 229/JWG 2 Measurement and characterization
- ISO/TC 229/TG 2 Sustainability, consumer and societal dimensions of nanotechnologies
- ISO/TC 229/WG 3 Health, Safety and Environmental Aspects of Nanotechnologies
- ISO/TC 229/WG 4 Material specifications
- ISO/TC 229/WG 5 Products and Applications

### **CLC/SR 113, Nanotechnology standardization for electrical and electronics products and systems**

CLC/SR 113, Nanotechnology standardization for electrical and electronics products and systems<sup>3</sup>, developed in 2014 the European standard EN 62607-3-1:2014, Nanomanufacturing - Key control characteristics - Part 3-1: Luminescent nanomaterials - Quantum efficiency. This document describes the procedures to be followed and precautions to be observed when performing reproducible measurements of the quantum efficiency of luminescent nanomaterials.

CLC/SR 113 is currently developing prEN 62565-3-1, Nanomanufacturing - Material specifications - Part 3-1: Graphene - Blank detail specification.

### **IEC/TC 113, Nanotechnology for electrotechnical products and systems**

The scope of IEC/TC 113, Nanotechnology for electrotechnical products and systems<sup>4</sup>, is the standardization of the technologies relevant to electrotechnical products and systems in the field of nanotechnology in close cooperation with other committees of IEC and ISO. It has developed an extensive number of deliverables.

The structure of IEC/TC 113 is the following:

- WG 3 Performance assessment. It develops standards for the assessment of performance related to the nanotechnology-enabled aspects of components and systems in support of continuous improvement at all stages of the value adding chain. WG 3 considers market demand and technology pull with an
- WG 7 Reliability. It develops standards for the assessment of reliability in the field of nano electrotechnology. Focus is on failure mechanisms and failure modes related to the use of nanomaterials, nanostructures, material interfaces and nanoscale contacts with consideration to size dependent effects.

<sup>2</sup> See <https://www.iso.org/committee/381983.html>

<sup>3</sup> See [https://www.cenelec.eu/dyn/www/f?p=104:7:422706435368801:::FSP\\_ORG\\_ID:1258659](https://www.cenelec.eu/dyn/www/f?p=104:7:422706435368801:::FSP_ORG_ID:1258659)

<sup>4</sup> See [https://www.iec.ch/dyn/www/f?p=103:7:13157006193278:::FSP\\_ORG\\_ID,FSP\\_LANG\\_ID:1315,25](https://www.iec.ch/dyn/www/f?p=103:7:13157006193278:::FSP_ORG_ID,FSP_LANG_ID:1315,25)

Standards to be developed include test methods to identify failure mechanisms, determine lifetime, analyse failure effects and estimate durability of nano-enabled products.

- WG 8 Graphene related materials/Carbon nanotube materials. It discusses and develops actual and new standardization project for graphene related materials and carbon nanotube materials
- WG 9 Nano-Enabled Photovoltaics Thin Film Organic/Nano Electronics, Nanoscale. It develops standards in the area of nano-enabled photovoltaics and organic electronics to facilitate the assurance of quality and reliability of materials and intermediates, subject to the general concepts of blank detail specifications (BDS) and Key Control Characteristics (KCCs).
- WG 10 Luminescent nanomaterials. It develops standards within the field of luminescent nanomaterials, which include quantum dots, dye-incorporated matrix nanoparticles, up-conversion nanoparticles, rare earth luminescent nanomaterials and others, with a focus on key control characteristics and test methods for performance, reliability, stability and others related to fabrication, processing and process control, disposal, recycling, etc.
- WG 11 Nano-enabled energy storage. It discusses and develops actual and new standardization project for nano-enabled energy storage.

### 2.3.3. Other European technical bodies developing standardisation deliverables focused on nanotechnologies

This subclause deals with other European technical bodies that have the aim of producing standardisation deliverables directly focusing on Nanotechnologies. Those<sup>5</sup> are:

- CEN/SS I44, Nanotechnologies
- CEN/WS MODA, Materials modelling terminology, classification and metadata

#### **CEN/SS I44, Nanotechnologies**

CEN/SS I44, Nanotechnologies<sup>6</sup> is a subsector created on 2005, in dates very close to the ones of the creation of CEN/TC 352. CEN/SS are typically created when the standardisation works on a specific area have no mirror technical body at CEN level. The works of the ISO technical body on nanotechnologies, ISO/TC 229, are covered by the activity of CEN/TC 352; this might explain why CEN/SS I44 has no workplan and has produced or adopted no standard. Therefore, the works of CEN/SS I44 are not relevant to the activities of OASIS.

#### **CEN/WS MODA, Materials modelling terminology, classification and metadata**

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<sup>5</sup> The works of CEN/WS 089, Platform, relevant to the development of guidelines and best practices for sustainable production of carbon nanotube-based nano-enabled products (CNT-based NEPs), are not considered in this report due to its initial stages of drafting.

<sup>6</sup> See [https://standards.cen.eu/dyn/www/f?p=204:7:0::::FSP\\_ORG\\_ID:509518&cs=1C6C7970D3C0CEEFC78BB4236A8831769](https://standards.cen.eu/dyn/www/f?p=204:7:0::::FSP_ORG_ID:509518&cs=1C6C7970D3C0CEEFC78BB4236A8831769)

CEN/WS MODA, Materials modelling terminology, classification and metadata<sup>7</sup> has its origin in the Review of Materials Modelling (RoMM) and the Materials Modelling Metadata (MODA) elaborated in the context of the European Materials Modelling Council (EMMC). The workshop seeks to establish a common terminology in materials modelling which should lead to simplified and much more efficient communication, especially benefitting industrial end users in their understanding and lowering the barrier to utilising materials modelling. The end result is the adoption of the CEN Workshop Agreement (CWA) CWA 17284:2018, Materials modelling - Terminology, classification and metadata, a best practices document for further standardisation efforts and input for the development of a future certification scheme.

#### 2.3.4. Other European technical bodies developing standardisation deliverables relevant to M/461

CEN/TC 137, Assessment of workplace exposure to chemical and biological agents, and CEN/TC 195, Air filters for general air cleaning, are the two CEN Technical Bodies that, in coordination with CEN/TC 352, develop standardisation deliverables that give an answer to M/461, highlighting its Working Groups CEN/TC 137/WG 3, Particulate matter, CEN/TC 137/WG 6, Dermal Exposure, and CEN/TC 195/WG 6, Execution of Mandate M/461.

##### **CEN/TC 137, Assessment of workplace exposure to chemical and biological agents**

The scope of CEN/TC 137, Assessment of workplace exposure to chemical and biological agents<sup>8</sup>, is the Standardization in the field of assessment of exposure to agents at the workplace including the planning and performing of measurement but excluding the establishment of limit values.

The works of CEN/TC 137 have a close relationship with those of ISO/TC 146/SC 2, Air quality. Workplace atmospheres<sup>9</sup>.

The structure of CEN/TC 137 is the following:

- CEN/TC 137/WG 2      General requirements for measuring procedures
- CEN/TC 137/WG 3      Particulate matter
- CEN/TC 137/WG 5      Measurement of biological agents
- CEN/TC 137/WG 6      Dermal Exposure

As stated previously, the works of WG 3 and WG 6 are relevant to nanotechnologies and to the activities of OASIS.

##### **CEN/TC 195, Air filters for general air cleaning**

CEN/TC 195, Air filters for general air cleaning<sup>10</sup>, is the definition of methods of testing and classification of air filters for general air cleaning.

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<sup>7</sup> See [https://standards.cen.eu/dyn/www/f?p=204:7:0:::FSP\\_ORG\\_ID:2301711&cs=1E88728758F1460484FE6AD7406F13C76](https://standards.cen.eu/dyn/www/f?p=204:7:0:::FSP_ORG_ID:2301711&cs=1E88728758F1460484FE6AD7406F13C76)

<sup>8</sup> See [https://standards.cen.eu/dyn/www/f?p=204:7:0:::FSP\\_ORG\\_ID:6119&cs=1577AF8CFFF976E2A620C9047E9F21EBF](https://standards.cen.eu/dyn/www/f?p=204:7:0:::FSP_ORG_ID:6119&cs=1577AF8CFFF976E2A620C9047E9F21EBF)

<sup>9</sup> See <https://www.iso.org/committee/52736.html>

<sup>10</sup> See [https://standards.cen.eu/dyn/www/f?p=204:7:0:::FSP\\_ORG\\_ID:6176&cs=1FB5AF452BC0AD5E457613B37BBCCBE54](https://standards.cen.eu/dyn/www/f?p=204:7:0:::FSP_ORG_ID:6176&cs=1FB5AF452BC0AD5E457613B37BBCCBE54)

The works of CEN/TC 195 have a close relationship with those of ISO/TC 142, Cleaning equipment for air and other gases<sup>11</sup>.

The structure of CEN/TC 195 is the following:

- CEN/TC 195/WG 1      Particulate air filters for general ventilation
- CEN/TC 195/WG 2      HEPA and ULPA filters
- CEN/TC 195/WG 5      Gas phase filters
- CEN/TC 195/WG 6      Execution of Mandate M/461

As stated previously, the works of WG 6 are relevant to nanotechnologies and to the activities of OASIS.

### 2.3.5. Other European technical bodies developing standardisation deliverables relevant to nanotechnologies

The scope of the following European Technical bodies is not nanotechnologies, although they have developed some standardisation deliverables relevant to it.

#### **CEN/TC 248/WG 26, Textiles -Test methods for analysis of EC restricted substances**

CEN/248/WG 26, Textiles - Test methods for analysis of EC restricted substances, is one of the Working Groups of CEN/TC 248, Textiles and textile products<sup>12</sup>.

The scope of CEN/TC 248 is the standardization of the following aspects of textiles, textile products and textile components of products:

- 1) test methods;
- 2) terms and definitions;
- 3) specifications, and if necessary, classifications, in terms of their expected behaviour, in particular where required by other CEN Technical Committees or the CEC or EFTA. Equipment relevant for the testing and use of textiles.

CEN/TC 248/WG 26 has recently developed CEN/TR 17222:2019. The aim of this document, based primarily on research studies that include information on the integration of the nanoparticles in the textile material, is to give some guidance on tests to nanoparticle release in textiles. The Pilot Lines of OASIS will not initially cover this kind of products, but this work is however relevant to nanotechnologies and therefore important to note.

#### **CEN/TC 264, Air quality**

The scope of CEN/TC 264, Air quality<sup>13</sup>, is the standardization of methods for air quality characterization of emissions, ambient air, indoor air, gases in and from the ground and deposition, in particular measurement methods for air pollutants (for example particles, gases, odours, microorganisms) and methods for the determination of the efficiency of gas cleaning systems. Excluded are: - the determination of limit values for air pollutants; - workplaces and clean rooms; - radioactive substances.

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<sup>11</sup> See <https://www.iso.org/committee/52624.html>

<sup>12</sup> See [https://standards.cen.eu/dyn/www/f?p=204:7:0:::FSP\\_ORG\\_ID:6229&cs=1CD56AD35AEB8C1A2E7CEE2BB715CAB9F](https://standards.cen.eu/dyn/www/f?p=204:7:0:::FSP_ORG_ID:6229&cs=1CD56AD35AEB8C1A2E7CEE2BB715CAB9F)

<sup>13</sup> See [https://standards.cen.eu/dyn/www/f?p=204:7:0:::FSP\\_ORG\\_ID:6245&cs=178094E67E1897102F190938A48C7A285](https://standards.cen.eu/dyn/www/f?p=204:7:0:::FSP_ORG_ID:6245&cs=178094E67E1897102F190938A48C7A285)

CEN/TC 264 has developed EN ISO 16017-2:2003. This document gives general guidance for the sampling and analysis of volatile organic compounds (VOCs) in air. Its lower limit of the useful range is comprised at nanogram and sub-nanogram level.

ISO/TC 146/SC 6, Indoor air<sup>14</sup>, is also responsible of EN ISO 16017-2, which belongs to a serie of standards on sampling and analysis of VOCs.

### **CEN/TC 298, Pigments and extenders**

The scope of CEN/TC 298, Pigments and extenders<sup>15</sup>, is the standardization in the field of pigments, dyestuffs and extenders. This includes the implementation of existing standards and drawing up of additional standards relating to terminology, general test methods, test methods related to the intended application and specifications for pigments, dyestuffs and extenders. The work related to the application of the above groups of products in textiles is excluded from its scope.

CEN/TC 298 has developed the serie of standards EN ISO 18473, on Functional pigments and extenders for special applications. Part 1, on nanoscale calcium carbonate for sealant application, and part 2, on nanoscale titanium dioxide for sunscreen application, are relevant to the field of nanotechnologies.

ISO/TC 256<sup>16</sup>, Pigments, dyestuffs and extenders, is also responsible of the serie of standards EN ISO 18473.

### **CEN/TC 430, Nuclear energy, nuclear technologies, and radiological protection**

The scope of CEN/TC 430, Nuclear energy, nuclear technologies, and radiological protection<sup>17</sup>, is the standardization in the field of peaceful applications of nuclear energy, nuclear technologies and in the field of the protection of individuals and the environment against all sources of ionising radiations.

This Technical Committee has developed EN ISO 15366-2:2016, which describes procedures to chemically separate and purify uranium and plutonium in dissolved solutions of irradiated light water reactor fuels and in samples of high active liquid waste of spent fuel reprocessing plants, prior to their isotopic analysis, and is applicable to samples containing plutonium and uranium amounts in the nanogram range and below.

ISO/TC 85/SC 5, Nuclear installations, processes and technologies<sup>18</sup> is also responsible of EN ISO 15366-2.

### **CEN/TC 459/SC 1, Test methods for steel (other than chemical analysis)**

The scope of CEN/TC 459/SC 1, Test methods for steel (other than chemical analysis)<sup>19</sup> is the standardization of general methods for mechanical testing, physico-chemical and non-destructive testing including if necessary, the

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<sup>14</sup> See <https://www.iso.org/committee/52822.html>

<sup>15</sup> See [https://standards.cen.eu/dyn/www/f?p=204:7:0:::FSP\\_ORG\\_ID:6279&cs=1C8A08124927CB3EA1F46E6789AA40D2F](https://standards.cen.eu/dyn/www/f?p=204:7:0:::FSP_ORG_ID:6279&cs=1C8A08124927CB3EA1F46E6789AA40D2F)

<sup>16</sup> See <https://www.iso.org/committee/618129.html>

<sup>17</sup> See [https://standards.cen.eu/dyn/www/f?p=204:7:0:::FSP\\_ORG\\_ID:1222800&cs=135C5BD09CE96834D187F87D97A85DDD2](https://standards.cen.eu/dyn/www/f?p=204:7:0:::FSP_ORG_ID:1222800&cs=135C5BD09CE96834D187F87D97A85DDD2)

<sup>18</sup> See <https://www.iso.org/committee/50328.html>

<sup>19</sup> See [https://standards.cen.eu/dyn/www/f?p=204:7:0:::FSP\\_ORG\\_ID:733642&cs=14BA103751C289759D79531BE065B6A8D](https://standards.cen.eu/dyn/www/f?p=204:7:0:::FSP_ORG_ID:733642&cs=14BA103751C289759D79531BE065B6A8D)

verification and calibration of testing equipment that is used to determine the properties of the steel. The test standards are sometimes applicable to all metallic materials.

Parts 1 and 4 of the serie EN ISO 14577, relevant to instrumented indentation test for hardness and materials parameters, are applicable to the nano and micro range.

ISO/TC 164/SC 3, Hardness testing<sup>20</sup>, is also responsible of the serie of standards, EN ISO 14577.

### **CLC/SR 47F, Micro-electromechanical systems**

CLC/SR 47F, Micro-electromechanical systems<sup>21</sup>, whose scope is within the field of semiconductors, has developed IEC 62047-17:2015. This document specifies the method for performing bulge tests on the free-standing film that is bulged within a window., being the specimen fabricated with micro/nano structural film materials, including metal, ceramic and polymer films, for MEMS, micromachines and others.

### **CLC/SR 68, Magnetic alloys and steels**

CLC/SR 68, Magnetic alloys and steels<sup>22</sup>, whose scope is within the field of the magnetic alloys, has developed the serie of standards EN IEC 60404, on magnetic materials. Parts 6 and 7 (under development) of this serie are applicable, among others, to nano-crystalline materials and alloys.

IEC/TC 68, Magnetic alloys and steels<sup>23</sup>, is also responsible of the serie of standards EN IEC 60404.

## **2.3.6. Other Standardisation Technical Bodies relevant to nanotechnologies**

### **Technical Committee E56 on Nanotechnology of ASTM International**

ASTM International, formerly known as American Society for Testing and Materials, has evolved from a national standards organisation, based in the USA, to an international one. Although it is not any of the three International standards organisations (ISO, IEC and ITU), its documents are widely used by the nanotechnologies community.

The scope of the Technical Committee E56 on Nanotechnology<sup>24</sup> of ASTM International is the development of standards and guidance for nanotechnology and nanomaterials, as well as the coordination between the existing ASTM standardization related to nanotechnology needs.

The structure of ASTM E56 is the following:

- E56.01 Informatics and Terminology
- E56.02 Physical and Chemical Characterization
- E56.03 Environment, Health, and Safety
- E56.04 Intellectual Property Issues

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<sup>20</sup> See <https://www.iso.org/committee/53558.html>

<sup>21</sup> See [https://www.cenelec.eu/dyn/www/f?p=104:7:422706435368801:::FSP\\_ORG\\_ID:1258711](https://www.cenelec.eu/dyn/www/f?p=104:7:422706435368801:::FSP_ORG_ID:1258711)

<sup>22</sup> See [https://www.cenelec.eu/dyn/www/f?p=104:7:422706435368801:::FSP\\_ORG\\_ID,FSP\\_LANG\\_ID:1258017,25](https://www.cenelec.eu/dyn/www/f?p=104:7:422706435368801:::FSP_ORG_ID,FSP_LANG_ID:1258017,25)

<sup>23</sup> See [https://www.iec.ch/dyn/www/f?p=103:7:0:::FSP\\_ORG\\_ID:1254](https://www.iec.ch/dyn/www/f?p=103:7:0:::FSP_ORG_ID:1254)

<sup>24</sup> See <https://www.astm.org/COMMITTEE/E56.htm>

- E56.05 Liaison and International Cooperation
- E56.06 Nano-Enabled Consumer Products
- E56.07 Education and Workforce Development
- E56.08 Nano-Enabled Medical Products
- E56.90 Executive
- E56.91 Strategic Planning and Review

### **American Concrete Institute, ACI**

The American Concrete Institute, ACI<sup>25</sup>, is a USA based organisation that develops some documents relevant to the activity of the OASIS network.

ACI Committee 241, Nanotechnology of Concrete, develops, reports, and disseminates information on the impact of nanotechnology and nanomaterials on the performance and durability of concrete. It produced in 2017 241R-17, Report on Application of Nanotechnology and Nanomaterials in Concrete. This report presents information on nanotechnology of concrete, including recent developments related to investigation of nanostructure and nanodesign of cement-based materials, the effects of nanoparticles, field applications, and health and environmental safety concerns related to the use of nanomaterials.

Another interesting ACI Committee is 440, Fiber-Reinforced Polymer Reinforcement. 440 developed in 2015 440.1R-15, Guide for the Design and Construction of Structural Concrete Reinforced with Fiber-Reinforced Polymer Bars. This guide offers general information on the history and use of Fiber-reinforced polymer (FRP) reinforcement, a description of the unique material properties of FRP, and guidelines for the design and construction of structural concrete members reinforced with FRP bars.

## **2.4. Relevant standardisation fields on Sustainable Manufacturing Framework**

Sustainability is the goal of sustainable development. It refers to any state of the global system in which the needs of the present are met without compromising the ability of future generations to meet their own needs. The concept of sustainability is continually evolving. Understanding and achieving a balance between environmental, social and economic systems, ideally in mutually supporting ways, is considered essential for making progress towards achieving sustainability. The achievement of sustainability is now recognized as one of the most important considerations in all human activities.

Sustainability shall consider three main aspects: social, environmental and economic.

This subclause lists and describes the main standardisation technical bodies working on sustainability aspects that are relevant to sustainable nano-manufacturing.

The main documents produced by those technical bodies are listed in subclause 2.6, Relevant standardization documents on sustainable manufacturing framework, of this report.

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<sup>25</sup> See <https://www.concrete.org/aboutaci.aspx>

### 2.4.1. Sustainability. General

#### **ISO/TMBG Technical Management Board – groups**

Sustainability is such a transversal and strategical issue that its main document at ISO level is under the direct responsibility of the ISO/TMBG. ISO/TMBG refers to the groups that report to the ISO Technical Management Board (TMB). The TMB is the governance body responsible for the general management of the technical committee structure within ISO, and it may establish ad hoc technical and strategic advisory groups (the ISO/TMBG) as deemed necessary to accomplish its responsibilities.

ISO Guide 82:2014, Guidelines for addressing sustainability in standards, is under the responsibility of ISO/TMBG. It defines sustainability as the state of the global system, including environmental, social and economic aspects, in which the needs of the present are met without compromising the ability of future generations to meet their own needs. This document, that is currently being revised (ISO/DGuide 82) provides a systematic approach to addressing sustainability issues in a coherent and consistent manner. It provides a process flow on how to address sustainability in standards. It also gives examples of different approaches to sustainability, and helps to identify the relevant sustainability issues that need to be addressed, making reference to those outlined in ISO 26000:2010.

#### **CEN/TC 352, Nanotechnologies**

The works of CEN/TC 352/WG 2, Commercial and other stakeholder aspects, and CEN/TC 352/WG 3, Health, safety and environmental aspects, are relevant to sustainability.

CEN/TS 16937:2016, Nanotechnologies - Guidance for the responsible development of nanotechnologies, drafted by CEN/TC 352/WG 2, should be highlighted. It provides a guidance for the responsible development of nanotechnologies taking into account:

- Board Accountability;
- Stakeholder Involvement;
- Worker Health and Safety;
- Benefits to and Risks for Public Health, Safety and the Environment;
- Wider Social and Ethical Implications and Impacts;
- Engagement with Business Partners;
- Transparency and Disclosure.

Another key document is CEN/TS 17276:2018, Nanotechnologies - Guidelines for Life Cycle Assessment - Application of EN ISO 14044:2006 to Manufactured Nanomaterials. Drafted by CEN/TC 352/WG 3, this document provides guidelines for application of Life Cycle Assessments (LCA) of specific relevance to manufactured nanomaterials (MNM), including their use in other products, according to EN ISO 14044:2006.



**CEN/WS 072, Framework for SustainValue - Sustainable Value Creation in manufacturing networks**

This CEN Workshop<sup>26</sup>, now disbanded, drafted CWA 16768:2014, Framework for Sustainable Value Creation in Manufacturing Network. This document covers good-practices for developing business models, governance models, sustainable solutions and performance management for existing and new sustainable production and service networks. It defines a Sustainable Business Modelling process and provides guidance to develop a Sustainability Performance Framework.

**ISO/TC 127, Earth-moving machinery**

ISO/TC 127<sup>27</sup> has produced three very interesting documents on the sustainability of earth-moving machinery: ISO 10987:2012, Earth-moving machinery -- Sustainability -- Terminology, sustainability factors and reporting; ISO 10987-2:2017, Earth-moving machinery -- Sustainability -- Part 2: Remanufacturing; and ISO 10987-3:2017, Earth-moving machinery -- Sustainability -- Part 3: Used machines.

Although it is a field with little or none relation to nanotechnologies, those documents are good examples of how to provide simple, meaningful and clear indicators on sustainability.

**CEN/TC 350, Sustainability of construction works**

CEN/TC 350<sup>28</sup> is the European Technical Body developing standardisation deliverables relevant to the sustainability of construction works. Its scope is the development of voluntary horizontal standardised methods for the assessment of the sustainability aspects of new and existing construction works and for standards for the environmental product declaration of construction products. The standards will be generally applicable (horizontal) and relevant for the assessment of integrated performance of buildings over its life cycle. The standards will describe a harmonized methodology for assessment of environmental performance of buildings and life cycle cost performance of buildings as well as the quantifiable performance aspects of health and comfort of buildings.

CEN/TC 350 has developed standards to assess the sustainability of the construction works, one group defining the framework (serie EN 15643) and another defining the calculation methods (EN 15978, EN 16309, EN 16627). It has also developed documents relevant to the Environmental Product Declaration (EPD) of construction products.

These documents are a good example of how to address the three sustainability aspects (social, environmental and economic).

**ISO/TC 59/SC 17, Sustainability in buildings and civil engineering works**

The approach of ISO/TC 59/SC 17<sup>29</sup> is quite different from the one of CEN/TC 350. It has produced two documents on the general principles (ISO 15392 and ISO/TS 12720), and two series covering the sustainability framework (ISO 21929 and ISO 21931). It has have also produced documents on the Environmental Product Declaration (EPD) of construction products, divergent with the ones of CEN/TC 350. ISO/TC 59/C 17 is also producing documents on

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<sup>26</sup>

See

[https://standards.cen.eu/dyn/www/f?p=204:7:0:::FSP\\_LANG\\_ID,FSP\\_ORG\\_ID:25,1168890&cs=11DF066248B676A106A5397DF283A76F0#1](https://standards.cen.eu/dyn/www/f?p=204:7:0:::FSP_LANG_ID,FSP_ORG_ID:25,1168890&cs=11DF066248B676A106A5397DF283A76F0#1)

<sup>27</sup> See <https://www.iso.org/committee/52172.html>

<sup>28</sup> See [https://standards.cen.eu/dyn/www/f?p=204:7:0:::FSP\\_ORG\\_ID:481830&cs=181BD0E0E925FA84EC4B8BCCC284577F8](https://standards.cen.eu/dyn/www/f?p=204:7:0:::FSP_ORG_ID:481830&cs=181BD0E0E925FA84EC4B8BCCC284577F8)

<sup>29</sup> See <https://www.iso.org/committee/322621.html>

benchmarking of the sustainability and on the disassembly of the construction works. Serie ISO 16745, on the carbon metric of existing buildings, is also under the responsibility of ISO/TC 59/SC 17.

### **Technical Committee E60.13 on Sustainable Manufacturing of ASTM International**

ASTM International, formerly known as American Society for Testing and Materials, has evolved from a national standards organisation, based in the USA, to an international one. Although it is not any of the three International standards organisations (ISO, IEC and ITU), its documents are widely used.

The Technical Committee E60.13 on Sustainable Manufacturing<sup>30</sup> of ASTM International Develops standards that manufacturers can use to benchmark, assess, act on, and communicate sustainability metrics, including standards for evaluating, improving, and measuring processes to produce finished goods.

### **OECD Sustainable Manufacturing Toolkit**

The Organisation for Economic Co-operation and Development (OECD) has launched a Sustainable Manufacturing Toolkit<sup>31</sup>. It aims to provide a practical starting point for businesses around the world to improve the efficiency of their production processes and products enabling them to contribute to sustainable development and green growth. The Toolkit includes an internationally applicable common set of indicators helping businesses measure their environmental performance at the level of a plant or facility. This edition focuses on the environmental aspects of sustainable development.

The Toolkit comprises:

- A start-up guide, which provides easy-to-read guidance to help the reader understand the basic issues and start measurement step by step.
- A web portal<sup>32</sup> that provides detailed explanation on indicators, technical advice on performance management and links to more guidance.

This toolkit is a good base towards building a sustainable manufacturing framework.

## **2.4.2. Sustainability. Social**

### **Specific nanotechnology standards supporting the social aspect of sustainability**

Many of the documents of CEN/TC 352, namely those of CEN/TC 352/WG 3, of ISO/TC 229, of CEN/TC 137 and of CEN/TC 195 cover the social aspects of nano-manufacturing, with a special focus on occupational health and safety. See 2.3 and 2.5 of this report for more information.

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<sup>30</sup> See <https://www.astm.org/COMMIT/SUBCOMMIT/E60.htm> and <https://www.astm.org/COMMIT/SUBCOMMIT/E6013.htm>

<sup>31</sup> See <http://www.oecd.org/innovation/green/toolkit/>

<sup>32</sup> See <http://www.oecd.org/innovation/green/toolkit/aboutsustainablemanufacturingandthetoolkit.htm>

## **Social responsibility**

As ISO Guide 82, the International Standard on Social Responsibility, ISO 26000, is under the direct responsibility of the ISO/TMBG. ISO 26000:2010 provides guidance rather than requirements, so it cannot be certified to unlike some other well-known ISO standards. Instead, it helps clarify what social responsibility is, helps businesses and organizations translate principles into effective actions and shares best practices relating to social responsibility, globally. It is aimed at all types of organizations regardless of their activity, size or location.

The standard was launched in 2010 following five years of negotiations between many different stakeholders across the world. Representatives from government, NGOs, industry, consumer groups and labour organizations around the world were involved in its development, which means it represents an international consensus.

## **ISO/TC 283, Occupational health and safety management**

The scope of ISO/TC 283, Occupational health and safety management<sup>33</sup>, is the standardization in the field of occupational health and safety management to enable an organization to control its OH&S risks and improve its OH&S performance.

Its main document is ISO 45001, Occupational health and safety management systems -- Requirements with guidance for use. This standard follows other generic management system approaches such as ISO 14001 and ISO 9001. It was based on earlier international standards in this area such as OHSAS 18001, the International Labour Organization's ILO-OSH Guidelines, various national standards and the ILO's international labour standards and conventions.

## **ISO/TC 262, Risk management**

The main document developed by ISO/TC 262, Risk management<sup>34</sup>, is ISO 31000:2018, Risk management – Guidelines. It provides principles, framework and a process for managing risk. It can be used by any organization regardless of its size, activity or sector. Using ISO 31000 can help organizations increase the likelihood of achieving objectives, improve the identification of opportunities and threats and effectively allocate and use resources for risk treatment. However, ISO 31000 cannot be used for certification purposes, but does provide guidance for internal or external audit programmes. Organizations using it can compare their risk management practices with an internationally recognised benchmark, providing sound principles for effective management and corporate governance.

## **Sustainable procurement**

The ISO/TMBG is also the responsible of ISO 20400:2017, Sustainable procurement – Guidance. This document provides guidelines for integrating sustainability into an organization's procurement processes. Aimed at top managers and directors of the purchasing function, it covers the political and strategic aspects of the purchasing process, namely how to align procurement with an organization's goals and objectives and create a culture of sustainability. The standard defines the principles of sustainable procurement, including accountability, transparency, respect for human rights and ethical behaviour, and highlights key considerations such as risk

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<sup>33</sup> See <https://www.iso.org/committee/4857129.html>

<sup>34</sup> See <https://www.iso.org/committee/629121.html>

management and priority setting. It also covers various stages of the procurement process, outlining the steps required to integrate social responsibility into the purchasing function.

## Safety of machinery

The scope of CEN/TC 114<sup>35</sup> and ISO/TC 199<sup>36</sup>, Safety of machinery, is the standardization of basic concepts and general principles for safety of machinery incorporating terminology, methodology, guards and safety devices within the framework of ISO / IEC Guide 51 and in cooperation with other ISO and IEC technical committees.

The main standards of the safety of machinery are included in their catalogue. In this report EN ISO 12100, Safety of machinery -- General principles for design -- Risk assessment and risk reduction, is highlighted, as it is the main basic standard on this subject.

Other Technical Committees, such as CEN/TC 122, Ergonomics<sup>37</sup>, and ISO/TC 159/SC 3, Anthropometry and biomechanics<sup>38</sup>, also produce deliverables relevant to the safety of machinery.

### 2.4.3. Sustainability. Environmental

#### ISO/TC 207, Environmental management

The scope of ISO/TC 207, Environmental management<sup>39</sup>, is the standardization in the field of environmental management systems and tools in support of sustainable development, excluding test methods of pollutants, setting limit values and levels of environmental performance, and standardization of products.

The structure of ISO/TC 207 is the following:

- ISO/TC 207/CAG 0 Chairman's advisory group
- ISO/TC 207/DCCG Developing Countries Coordination Group
- ISO/TC 207/STTF Spanish translation task force
- ISO/TC 207/TCG Terminology Coordination Group
- ISO/TC 207/TG 1 Sustainable Finance Coordination
- ISO/TC 207/TG 2 Circular economy coordination
- ISO/TC 207/WG 8 Material flow cost accounting – General principles and framework
- ISO/TC 207/WG 9 Land degradation and desertification
- ISO/TC 207/WG 10 Environmentally conscious design
- ISO/TC 207/WG 11 Green finance

<sup>35</sup> See [https://standards.cen.eu/dyn/www/f?p=204:7:0:::FSP\\_ORG\\_ID:6096&cs=149351BC7EBFB63CC332FEC57AAAAEF2B](https://standards.cen.eu/dyn/www/f?p=204:7:0:::FSP_ORG_ID:6096&cs=149351BC7EBFB63CC332FEC57AAAAEF2B)

<sup>36</sup> See <https://www.iso.org/committee/54604.html>

<sup>37</sup> See [https://standards.cen.eu/dyn/www/f?p=204:7:0:::FSP\\_ORG\\_ID:6104&cs=17B26A46FEC153FA622114FF1C49C7C75](https://standards.cen.eu/dyn/www/f?p=204:7:0:::FSP_ORG_ID:6104&cs=17B26A46FEC153FA622114FF1C49C7C75)

<sup>38</sup> See <https://www.iso.org/committee/53362.html>

<sup>39</sup> See <https://www.iso.org/committee/54808.html>

- ISO/TC 207/SC 1 Environmental management systems
- ISO/TC 207/SC 2 Environmental auditing and related environmental investigations
- ISO/TC 207/SC 3 Environmental labelling
- ISO/TC 207/SC 4 Environmental performance evaluation
- ISO/TC 207/SC 5 Life cycle assessment
- ISO/TC 207/SC 7 Greenhouse gas management and related activities

Its main document relevant to the environmental aspect of sustainable manufacturing is EN ISO 14001, Environmental management systems -- Requirements with guidance for use.

Other relevant document is EN ISO 14031:2013, Environmental management -- Environmental performance evaluation – Guidelines, provides guidance on how an organization can evaluate its environmental performance. The standard also addresses the selection of suitable performance indicators, so that performance can be assessed against criteria set by management.

Finally, the serie ISO 14040 standards give guidelines on the principles and conduct of LCA studies that provide an organization with information on how to reduce the overall environmental impact of its products and services.

#### 2.4.4. Sustainability. Economic

##### **ISO/TC 176/SC 2 , Quality systems**

The works of ISO/TC 176/SC 2 , Quality systems<sup>40</sup>, namely ISO 9001, Quality management systems – Requirements, have a direct relationship with the fulfilment of the economic aspects of sustainability of a process such as nano-manufacturing.

Implementing a quality management system helps organisations to:

- Assess its overall context to define who is affected by its work and what they expect from it.
- Put customers first, making sure the organisation meets their needs and exceeds their expectations.
- Work in a more efficient way, increasing productivity and efficiency.
- Meet the necessary statutory and regulatory requirements.
- Expand into new markets, as some sectors and clients require ISO 9001
- Identify and address the risks associated with its activity.

#### **Digitalisation**

Digitalisation is one of the key challenges for any organisation, allowing cooperative business models that use all the information generated and the technological advances implemented, fully integrated with other processes, products and services. However, digital transformation such as the implementation of technological enablers related to industry 4.0 usually experiences resistances. UNE, the Spanish standards body, has developed two documents with the aim of helping to reduce the digital break in those organisations that would like to be considered as Digital Industries. Those documents are Especificación UNE 0060:2018, Industry 4.0. Management

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<sup>40</sup> See <https://www.iso.org/committee/53896.html>

system for digitization. Requirements, and Especificación UNE 0061:2019, Industry 4.0. Management system for digitization. Requirements assessment.

## 2.5. Relevant standardization documents on nanotechnologies

### 2.5.1. Main European and International technical bodies developing standards focused on nanotechnologies

#### CEN/TC 352 and ISO/TC 229, Nanotechnologies

At European and International level, the workplan of the CEN/TC 352 and of ISO/TC 229, both titled Nanotechnologies, including the standards already published, comprises the following documents. Due to the high relevance of these works to OASIS, its scope is indicated. The information on the scope of the standards in early stages of development, due to obvious reasons, is not available and therefore is not provided in this report.

#### General documents, including terminology and nomenclature, material specifications and products and applications:

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
	IEC/CD 62565-3-1	Nanomanufacturing -- Material specifications -- Part 3-1: Graphene -- Blank detail specification		Under development		ISO/TC 229	-
	IEC/TS 80004-9:2017	Nanotechnologies -- Vocabulary -- Part 9: Nano-enabled electrotechnical products and systems	IEC TS 80004-9: 2017(E) specifies terms and definitions for electrotechnical products and systems reliant on nanomaterials for their essential functionalities. It is intended to facilitate communications between organizations and individuals in industry and those who interact with them.	Published		ISO/TC 229	-
	ISO/AWI TS 19807-2	Nanotechnologies -- Magnetic nanomaterials -- Part 2: Specification of characteristics and		Under development		ISO/TC 229/WG 4	-

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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
		measurements for nanostructured superparamagnetic beads for nucleic acid extraction					
	ISO/AWI TS 23650	Nanotechnologies -- Evaluation of the antimicrobial performance of textiles containing manufactured nanomaterials		Under development		ISO/TC 229/WG 5	-
prEN ISO 17200	ISO/DIS 17200	Nanotechnology - Nanoparticles in powder form - Characteristics and measurements (ISO/DIS 17200:2019)		Under development	CEN/TC 352	ISO/TC 229/WG 4	VA/ISO Lead
	ISO/DTS 19808	Nanotechnology - Specifications for Carbon Nanotube Suspension: characteristics and test methods		Under development		ISO/TC 229/WG 4	-
	ISO/DTS 21236-1	Nanotechnologies -- Clay nanomaterials -- Part 1: Specification of characteristics and measurement methods		Under development		ISO/TC 229/WG 4	-
	ISO/DTS 21236-2	Nanotechnologies -- Clay nanomaterials -- Part 2: Specification of clay nanomaterials used for gas barrier films		Under development		ISO/TC 229/WG 4	-



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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
	ISO/DTS 21237	Nanotechnologies -- Nano-enhanced air filter media using nanofibres -- Characteristics, performance and measurement methods		Under development		ISO/TC 229/WG 4	-
	ISO/DTS 21412	Nanotechnologies -- Nanostructured layers for enhanced electrochemical bio-sensing applications -- Characteristics and measurements		Under development		ISO/TC 229/WG 4	-
	ISO/DTS 21975	Nanotechnologies -- Polymeric nanocomposite films for food packaging -- Barrier properties: characteristics and measurement methods		Under development		ISO/TC 229/WG 4	-
	ISO/NP TS 23362	Nanostructured porous alumina as catalyst support for vehicle exhaust emission control -- Material specification		Under development		ISO/TC 229/WG 4	-
prCEN ISO/TS 80004-3 rev	ISO/NP TS 80004-3	Nanotechnologies -- Vocabulary -- Part 3: Carbon nano-objects		Under development	CEN/TC 352	ISO/TC 229/JWG 1	VA/ISO Lead
	ISO/NP TS 80004-4	Nanotechnologies -- Vocabulary -- Part 4: Nanostructured materials		Under development		ISO/TC 229/JWG 1	FROZEN Parallel (lead to be defined)

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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
	ISO/NP TS 80004-6	Nanotechnologies -- Vocabulary -- Part 6: Nano-object characterization		Under development		ISO/TC 229/JWG 1	ISO lead, parallel
	ISO/NP TS 80004-8	Nanotechnologies -- Vocabulary -- Part 8: Nanomanufacturing processes		Under development		ISO/TC 229/JWG 1	ISO lead, parallel
	ISO/PWI 22802	Nanofluids for heat transfer applications -- Specification of characteristics, performance and measurement methods		Under development		ISO/TC 229/WG 4	-
	ISO/PWI 23366	Nanotechnologies - Performance evaluation of quantification methods of biomolecules using fluorescent nanoparticles		Under development		ISO/TC 229/WG 5	-
	ISO/TR 11360:2010	Nanotechnologies -- Methodology for the classification and categorization of nanomaterials	ISO/TR 11360:2010 describes a classifying system, termed a "nano-tree", upon whose basis wide ranges of nanomaterials can be categorized, including nano-objects, nanostructures and nanocomposites of various dimensionality of different physical, chemical, magnetic and biological properties.	Published		ISO/TC 229/JWG 1	-
	ISO/TR 12802:2010	Nanotechnologies -- Model taxonomic framework for use	ISO/TR 12802:2010 establishes core concepts for nanotechnology in a model	Published		ISO/TC 229/JWG 1	-

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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
		in developing vocabularies -- Core concepts	taxonomic framework. It is intended to facilitate communication and promote common understanding.				
	ISO/TR 14786:2014	Nanotechnologies -- Considerations for the development of chemical nomenclature for selected nano-objects	ISO/TR 14786:2014 is intended to provide information and analyses in support of the development of chemical nomenclature for the naming of "nano-objects". "Nano-objects" have been defined in ISO/TS 80004-1:2010 to mean "materials with one, two, or three external dimensions in the nanoscale", with the nanoscale defined as the "size range from approximately 1 nm to 100 nm". Nano-objects are further defined as nanoplates, nanofibres, and nanoparticles. More specifically, the nano-objects that are the subject of ISO/TR 14786:2014 are discrete chemical entities rather than devices or mixtures (preparations). The nano-objects discussed in this Technical Report are not intended to constitute an exhaustive list. ISO/TR	Published		ISO/TC 229	-

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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			14786:2014 is intended to facilitate communications between developers and potential users of nomenclature including academia, industry, government and non-governmental organizations.				
	ISO/TR 17302:2015	Nanotechnologies -- Framework for identifying vocabulary development for nanotechnology applications in human healthcare	ISO/TR 17302:2015 will not attempt a formal, comprehensive definition of "nanomedicine". Instead, it will provide a taxonomic framework for the development of vocabulary for clinical applications of nanotechnologies in human healthcare. While it is understood that the origins of nanotechnologies for healthcare applications emerge from pre-clinical and translational research, the interest of this Technical Report is to determine where these technologies will impact the clinical value chain and the practice of medicine. ISO/TR 17302:2015 is intended to facilitate communications between developers and users	Published		ISO/TC 229	-

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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			of nanotechnologies, deliverers and users of medicine including the pharmaceutical, research and medical communities, regulatory professionals, and additional organizations and individuals who might interact with these groups, including biotechnology, diagnostic, and medical device companies, the life sciences, patent attorneys and patent offices, institutional review boards, ethics review boards, and accreditation organizations.				
prCEN ISO/TR 18401	ISO/TR 18401:2017	Nanotechnologies - Plain language explanation of selected terms from the ISO/IEC 80004 series	ISO/TR 18401:2017 is intended to assist stakeholders who are making decisions about the direction, management and application of nanotechnologies to better understand selected key terms and definitions in the ISO/IEC 80004 vocabulary series for nanotechnologies.	Under development	CEN/TC 352	ISO/TC 229	No
	ISO/TS 11931:2012	Nanotechnologies -- Nanoscale calcium carbonate in powder form --	ISO/TS 11931:2012 provides requirements to describe the basic characteristics of nanoscale calcium carbonate	Published		ISO/TC 229/WG 4	-

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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
		Characteristics and measurement	in powder form relevant for applications in nanotechnology. It is intended to detail the material specification necessary to use CaCO <sub>3</sub> in the applications related to nanotechnology. It does not cover characteristics specific for health and safety issues, and for specific applications of nanoscale CaCO <sub>3</sub> .				
	ISO/TS 11937:2012	Nanotechnologies -- Nanoscale titanium dioxide in powder form -- Characteristics and measurement	ISO/TS 11937 provides requirements to describe the basic characteristics of titanium dioxide in powder form relevant for applications in nanotechnology. It is intended to detail the materials specification necessary to use titanium dioxide in the applications related to nanotechnology. It is limited to dry powders and does not include materials dispersed or suspended in water or solvents. It does not cover characteristics for health and safety issue, and for specific application of titanium	Published		ISO/TC 229/WG 4	-

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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			dioxide or for surface modification, if coated.				
	ISO/TS 12805:2011	Nanotechnologies -- Materials specifications -- Guidance on specifying nano-objects	ISO/TS 12805:2011 provides guidance on the preparation of specifications for the characteristics of manufactured nano-objects and their measurement methods. This is intended to help ensure the delivery of products with consistent properties for subsequent processing and/or final product performance. ISO/TS 12805:2011 includes guidance on specifying the physical and chemical characteristics of manufactured nano-objects, which might affect performance or subsequent processing.	Published		ISO/TC 229/WG 4	-
	ISO/TS 18110:2015	Nanotechnologies -- Vocabularies for science, technology and innovation indicators	ISO/TS 18110:2015 aims to provide the necessary definitions that specify the bounds of key innovation indicators as they relate to nanotechnology, in order to facilitate and unify the global assessment of nanotechnology	Published		ISO/TC 229	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			activities in different areas. The availability of these terms can help the measurement and comparison of various indicators in this field. This Technical Specification does not intend to redefine terms that are already defined in other ISO documents. Furthermore, there is no intention to show how the indicators can be used as an assessment tool.				
	ISO/TS 19807-1:2019	Nanotechnologies -- Magnetic nanomaterials -- Part 1: Specification of characteristics and measurements for magnetic nanosuspensions	This document specifies the characteristics of magnetic nanosuspensions to be measured and lists measurement methods for measuring these characteristics. This is a generic document and does not deal with any particular application.	Published		ISO/TC 229/WG 4	-
	ISO/TS 20477:2017	Nanotechnologies -- Standard terms and their definition for cellulose nanomaterial	ISO/TS 20477:2017 defines terms and definitions for different types of cellulose nanomaterials including secondary components found in cellulose nanomaterials due to their manufacturing	Published		ISO/TC 229	-



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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			processes. The document also gives information on cellulose micromaterials in Annex A. Where necessary, terms from the ISO/IEC 80004 vocabulary series are included in this document. Terms in this document are applicable to all types of cellulose nanomaterials regardless of production methods and their origin (plants, animals, algae or bacteria).				
CEN ISO/TS 80004-1:2015	ISO/TS 80004-1:2015	Nanotechnologies - Vocabulary - Part 1: Core terms (ISO/TS 80004-1:2015)	ISO/TS 80004-1:2015 lists terms and definitions related to core terms in the field of nanotechnologies. It is intended to facilitate communications between organizations and individuals in industry and those who interact with them.	Published	CEN/TC 352	ISO/TC 229/JWG 1	VA/ISO Lead
	ISO/TS 80004-11:2017	Nanotechnologies -- Vocabulary -- Part 11: Nanolayer, nanocoating, nanofilm, and related terms	ISO/TS 80004-11:2017 lists terms and definitions, and specifies an extensible taxonomic terminology framework for nanolayers, nanocoatings, nanofilms, and related terms in the field of nanotechnologies.	Published		ISO/TC 229/JWG 1	-

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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
CEN ISO/TS 80004-12:2017	ISO/TS 80004-12:2016	Nanotechnologies - Vocabulary - Part 12: Quantum phenomena in nanotechnology (ISO/TS 80004-12:2016)	ISO/TS 80004-12:2016 lists terms and definitions relevant to quantum phenomena in nanotechnologies. All of these terms are important for nanotechnologies, but it is to be noted that many of them are not exclusively relevant to the nanoscale and can also be used to some extent to refer to larger scales. The list of terms presented does not claim to provide exhaustive coverage of the whole spectrum of quantum concepts and phenomena in nanotechnology. It covers important phenomena as acknowledged by many stakeholders from academia, industry, etc. ISO/TS 80004-12:2016 is intended to facilitate communication between organizations and individuals in industry and those who interact with them.	Published	CEN/TC 352	ISO/TC 229/JWG 1	-
	ISO/TS 80004-13:2017	Nanotechnologies -- Vocabulary -- Part 13: Graphene and related two-dimensional (2D) materials	ISO/TS 80004-13:2017 lists terms and definitions for graphene and related two-dimensional (2D) materials, and includes related terms	Published		ISO/TC 229	-

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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			naming production methods, properties and their characterization. It is intended to facilitate communication between organizations and individuals in research, industry and other interested parties and those who interact with them.				
CEN ISO/TS 80004-2:2017	ISO/TS 80004-2:2015	Nanotechnologies - Vocabulary - Part 2: Nano-objects (ISO/TS 80004-2:2015)	ISO/TS 80004-2:2015 lists terms and definitions related to particles in the field of nanotechnologies.	Published	CEN/TC 352	ISO/TC 229	-
CEN ISO/TS 80004-3:2014	ISO/TS 80004-3:2010	Nanotechnologies - Vocabulary - Part 3: Carbon nano-objects (ISO/TS 80004-3:2010)	ISO/TS 80004-3:2010 lists terms and definitions related to carbon nano-objects in the field of nanotechnologies. It is intended to facilitate communications between organizations and individuals in industry and those who interact with them.	Published	CEN/TC 352	ISO/TC 229/JWG 1	-
CEN ISO/TS 80004-4:2014	ISO/TS 80004-4:2011	Nanotechnologies - Vocabulary - Part 4: Nanostructured materials (ISO/TS 80004-4:2011)	ISO/TS 80004-4:2011 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	Published	CEN/TC 352	ISO/TC 229/JWG 1	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			those nanoscale regions. It is intended to facilitate communications between organizations and individuals in industry and those who interact with them. 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. ISO/TS 80004-4:2011 includes nanodispersion.				
	ISO/TS 80004-5:2011	Nanotechnologies -- Vocabulary -- Part 5: Nano/bio interface	ISO/TS 80004-5:2011 lists terms and definitions related to the interface between nanomaterials and biology. It is intended to facilitate communications between scientists, engineers, technologists, designers, manufacturers, regulators, NGOs, consumer organizations, members of the public and others with an interest in: the application or	Published		ISO/TC 229/JWG 1	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			use of nanotechnologies in biology or biotechnology; the use of biological matter or principles in nanotechnology.				
CEN ISO/TS 80004-6:2015	ISO/TS 80004-6:2013	Nanotechnologies - Vocabulary - Part 6: Nano-object characterization (ISO/TS 80004-6:2013)	ISO/TS 80004-6:2013 lists terms and definitions relevant to the characterization of nano-objects.	Published	CEN/TC 352	ISO/TC 229/JWG 1	-
	ISO/TS 80004-7:2011	Nanotechnologies -- Vocabulary -- Part 7: Diagnostics and therapeutics for healthcare	ISO/TS 80004-7:2011 is applicable to the use of nanotechnologies in medical diagnostics and therapeutics. Terms relating to the applications of nanotechnology in healthcare might also be addressed in other parts of ISO/TS 80004 and in other documents. Terms relating to the exploitation of material features at the nanoscale for diagnostic or therapeutic purposes in relation to human disease come within the scope of ISO/TS 80004-7:2011. Nanoscale properties can be embodied in materials that contain nanoscale elements, or are themselves of nanoscale dimensions. ISO/TS 80004-	Published		ISO/TC 229/JWG 1	FROZEN Parallel (ISO lead)

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			7:2011 provides consistent and unambiguous use of terms for healthcare professionals, manufacturers, consumers, technologists, patent agents, regulators, NGOs, and researchers, etc.				
CEN ISO/TS 80004-8:2015	ISO/TS 80004-8:2013	Nanotechnologies - Vocabulary - Part 8: Nanomanufacturing processes (ISO/TS 80004-8:2013)	ISO/TS 80004-8:2013 gives terms and definitions related to nanomanufacturing processes in the field of nanotechnologies. It forms one part of multi-part terminology and definitions documentation covering the different aspects of nanotechnologies.	Published	CEN/TC 352	ISO/TC 229/JWG 1	-
prCEN ISO/TS 80004-11		Nanotechnologies - Vocabulary - Part 11: Nanolayer, nanocoating, nanofilm, and related terms		Under development	CEN/TC 352		-
prCEN ISO/TS 80004-13		Nanotechnologies - Vocabulary - Part 13: Graphene and related two-dimensional (2D) materials		Under development	CEN/TC 352		-
prCEN ISO/TS 80004-2		Nanotechnologies - Vocabulary - Part 2: Nano-objects: Nanoparticle, nanofibre and nanoplate		Under development	CEN/TC 352		VA/ISO Lead

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
prCEN ISO/TS 80004- 8 rev		Nanotechnologies - Vocabulary - Part 8: Nanomanufacturing processes		Under development	CEN/TC 352		VA/ISO Lead

**Measurement, characterization and performance evaluation**

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
	IEC/AWI 62607-6-3	Nanomanufacturing -- Key control characteristics -- Graphene - Characterization of graphene domains and defects -- Part 6-3:		Under development		ISO/TC 229	-
	IEC/AWI TR 63258	Measurement of film thickness of nanomaterials by using ellipsometry		Under development		ISO/TC 229/JWG 2	-
	IEC/TS 62622:2012	Artificial gratings used in nanotechnology -- Description and measurement of dimensional quality parameters	IEC/TS 62622:2012(E), which is a technical specification, specifies the generic terminology for the global and local quality parameters of artificial gratings, interpreted in terms of deviations from nominal positions of grating features, and provides guidance on the categorization of measurement and evaluation methods for their determination. This specification is intended to facilitate communication among manufacturers, users and calibration laboratories dealing with the characterization of the dimensional quality	Published		ISO/TC 229/JWG 2	-



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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			parameters of artificial gratings used in nanotechnology. This specification supports quality assurance in the production and use of artificial gratings in different areas of application in nanotechnology. Whilst the definitions and described methods are universal to a large variety of different gratings, the focus is on one-dimensional (1D) and two-dimensional (2D) gratings.				
	ISO/AWI TS 21356-1	Nanotechnologies -- Structural characterization of graphene -- Part 1: Graphene from powders and dispersions		Under development		ISO/TC 229/JWG 2	-
	ISO/AWI TS 21357	Nanotechnologies -- Evaluation of the mean size of nano-objects in liquid dispersions by static multiple light scattering (SMLS)		Under development		ISO/TC 229/JWG 2	-
	ISO/AWI TS 22292	Nanotechnologies -- 3D image reconstruction of nano-objects using transmission electron microscopy		Under development		ISO/TC 229/JWG 2	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
	ISO/AWI TS 23302	Nanotechnologies -- Guidance on measurands for characterising nano-objects and materials that contain them		Under development		ISO/TC 229/JWG 2	-
	ISO/DIS 19749	Nanotechnologies -- Measurements of particle size and shape distributions by scanning electron microscopy		Under development		ISO/TC 229/JWG 2	-
	ISO/DIS 20814	Nanotechnologies -- Testing of the photocatalytic activity of nanoparticles for NADH oxidation		Under development		ISO/TC 229	-
	ISO/DIS 21363	Nanotechnologies -- Measurements of particle size and shape distributions by transmission electron microscopy		Under development		ISO/TC 229/JWG 2	-
	ISO/DTS 10798	Nanotechnologies -- Characterization of carbon nanotubes using scanning electron microscopy and energy dispersive X-ray spectrometry		Under development		ISO/TC 229/JWG 2	FROZEN Parallel (ISO lead)
	ISO/DTS 10867	Nanotechnologies -- Characterization of single-wall carbon nanotubes using near infrared		Under development		ISO/TC 229/JWG 2	-

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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
		photoluminescence spectroscopy					
	ISO/DTS 11308	Nanotechnologies -- Characterization of carbon nanotubes using thermogravimetric analysis		Under development		ISO/TC 229/JWG 2	-
	ISO/DTS 21346	Nanotechnologies - Characterization of individualized cellulose nanofibril samples		Under development		ISO/TC 229/JWG 2	-
	ISO/NP 21362	Nanotechnologies -- Analysis of nano-objects using asymmetrical-flow and centrifugal field-flow fractionation		Under development		ISO/TC 229/JWG 2	-
prCEN ISO/TS 12025 rev	ISO/NP TS 12025	Nanomaterials - Quantification of nano-object release from powders by generation of aerosols		Under development	CEN/TC 352	ISO/TC 229/JWG 2	VA/ISO Lead
	ISO/NP TS 23151	Nanotechnologies -- Particle size distribution for cellulose nanocrystals		Under development		ISO/TC 229/JWG 2	-
	ISO/PRF TS 11251	Nanotechnologies -- Characterization of volatile components in single-wall carbon nanotube samples using evolved gas analysis/gas chromatograph-mass spectrometry		Under development		ISO/TC 229/JWG 2	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
	ISO/PWI 23359	Nanotechnologies -- Chemical characterization of graphene in in powders and suspensions		Under development		ISO/TC 229/JWG 2	-
	ISO/PWI 23361	Nanotechnologies - Crystallinity of cellulose nanomaterials by powder X-ray diffraction (Ruland-Rietveld analysis)		Under development		ISO/TC 229/JWG 2	-
	ISO/PWI 23367	Nanotechnologies -- Performance characteristics of nanosensors for biomolecule detection		Under development		ISO/TC 229	-
	ISO/PWI 23652-1	Performance evaluation of nanomaterials -- Biodistribution study using radiolabelled nanomaterials - - Part 1: Radiolabelling of nanomaterials for biodistribution study		Under development		ISO/TC 229	-
	ISO/PWI 23653	Performance evaluation of nanomedicine and nanoparticle using 3D cell culture system for their uptake at cellular level		Under development		ISO/TC 229	-
	ISO/PWI 23690	Nanotechnologies -- Carbon nanotubes -- Determination of amorphous carbon content by thermogravimetric analysis		Under development		ISO/TC 229/JWG 2	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
	ISO/PWI 23878	Nanotechnologies -- Positron annihilation lifetime measurement for nanopore evaluation in materials		Under development		ISO/TC 229/JWG 2	-
	ISO/PWI 23879	Nanotechnologies -- Structural characterization of graphene oxide flakes: thickness and lateral size measurement using AFM and SEM		Under development		ISO/TC 229/JWG 2	-
	ISO/PWI TS 21356-2	Nanotechnologies -- Structural characterization of graphene -- Part 2: Chemical vapour deposition (CVD) grown graphene		Under development		ISO/TC 229/JWG 2	-
CEN ISO/TR 11811:2012	ISO/TR 11811:2012	Nanotechnologies - Guidance on methods for nano- and microtribology measurements (ISO/TR 11811:2012)	ISO/TR 11811:2012 establishes techniques for the evaluation of tribological performance of sliding contacts with a lateral size of between a few nanometres and 10 µm, and where the applied load is between 50 µN and 100 mN. It describes procedures for undertaking these measurements, and provides guidance on the effect of parameters on test results. It does not cover existing SPM techniques, such as frictional	Published	CEN/TC 352	ISO/TC 229	VA/CEN Lead

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			force microscopy and atomic force microscopy (AFM).				
	ISO/TR 18196:2016	Nanotechnologies -- Measurement technique matrix for the characterization of nano-objects	ISO/TR 18196:2016 provides a matrix that guides users to commercially available techniques relevant to the measurements of common physiochemical parameters for nano-objects. Some techniques are also applicable to nanostructured materials.	Published		ISO/TC 229	-
	ISO/TR 19057:2017	Nanotechnologies -- Use and application of acellular in vitro tests and methodologies to assess nanomaterial biodurability	ISO/TR 19057:2017 reviews the use and application of acellular in vitro tests and methodologies implemented in the assessment of the biodurability of nanomaterials and their ligands in simulated biological and environmental media. ISO/TR 19057:2017 is intended to focus more on acellular in vitro methodologies implemented to assess biodurability and, therefore, excludes the general review of relevant literature on in vitro cellular or animal biodurability tests.	Published		ISO/TC 229	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
	ISO/TR 19716:2016	Nanotechnologies -- Characterization of cellulose nanocrystals	ISO/TR 19716:2016 reviews commonly used methods for the characterization of cellulose nanocrystals (CNCs), including sample preparation, measurement methods and data analysis. Selected measurands for characterization of CNCs for commercial production and applications are covered. These include CNC composition, morphology and surface characteristics.	Published		ISO/TC 229	-
	ISO/TR 19733:2019	Nanotechnologies -- Matrix of properties and measurement techniques for graphene and related two-dimensional (2D) materials	This document provides a matrix which links key properties of graphene and related two-dimensional (2D) materials to commercially available measurement techniques. The matrix includes measurement techniques to characterize chemical, physical, electrical, optical, thermal and mechanical properties of graphene and related 2D materials.	Published		ISO/TC 229	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
	ISO/TR 20489:2018	Nanotechnologies -- Sample preparation for the characterization of metal and metal-oxide nano-objects in water samples	This document provides an overview of approaches of sample preparation (i.e. pre-treatment and size-fractionation) for analytical measurements applied to surface and drinking water, potentially containing relevant amounts and types of metal and metal oxide nano-objects, including collection from source and storage of samples, pre-concentration of analytes, and their fractionation.	Published		ISO/TC 229	FROZEN Parallel (ISO lead)
CEN ISO/TS 12025:2015	ISO/TS 12025:2012	Nanomaterials - Quantification of nano-object release from powders by generation of aerosols (ISO/TS 12025:2012)	ISO/TS 12025:2012 provides methodology for the quantification of nano-object release from powders as a result of treatment, ranging from handling to high energy dispersion, by measuring aerosols liberated after a defined aerosolization procedure. In addition to information in terms of mass, the aerosol is characterized for particle concentrations and size distributions. ISO/TS 12025:2012 provides information on factors to be considered when selecting	Published	CEN/TC 352	ISO/TC 229/JWG 2	-



## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			from the available methods for powder sampling and treatment procedures and specifies minimum requirements for test sample preparation, test protocol development, measuring particle release and reporting data. In order to characterize the full size range of particles generated, the measurement of nano-objects as well as agglomerates and aggregates is recommended in ISO/TS 12025:2012.				
	ISO/TS 14101:2012	Surface characterization of gold nanoparticles for nanomaterial specific toxicity screening: FT-IR method	ISO/TS 14101:2012 provides guidelines for the identification of the surface bound molecules using FT-IR of dehydrated gold nanoparticle (AuNPs) films both before and after nanomaterial (NM) cytotoxicity testing.	Published		ISO/TC 229	-
	ISO/TS 16195:2018	Nanotechnologies -- Specification for developing representative test materials consisting of nano-objects in dry powder form	This document specifies development of representative test materials consisting of nano-objects in dry powder form, to enable test method development and improve comparability of data for	Published		ISO/TC 229/JWG 2	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			nanotechnology applications. It includes the physico-chemical properties (specifically, size and shape, specific surface area, crystal structure, and bulk chemical composition) that are required to be measured and reported with the representative test material.				
	ISO/TS 16550:2014	Nanotechnologies -- Determination of silver nanoparticles potency by release of muramic acid from <i>Staphylococcus aureus</i>	ISO/TS 16550:2014 provides a test method for evaluating potency of silver nanoparticles to cell wall degradation of <i>Staphylococcus aureus</i> and muramic acid release as quantified by a gas chromatography-mass spectrometry (GC-MS).	Published		ISO/TC 229	-
CEN ISO/TS 17200:2015	ISO/TS 17200:2013	Nanotechnology - Nanoparticles in powder form - Characteristics and measurements (ISO/TS 17200:2013)	ISO/TS 17200:2013 lists fundamental characteristics which are commonly determined for nanoparticles in powder form. ISO/TS 17200:2013 prescribes specific measurement methods for each of these characteristics.	Published	CEN/TC 352	ISO/TC 229	-
	ISO/TS 17466:2015	Use of UV-Vis absorption spectroscopy in the characterization of cadmium	ISO/TS 17466:2015 provides guidelines for estimating the diameter and the number	Published		ISO/TC 229	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
		chalcogenide colloidal quantum dots	concentration of monodisperse cadmium chalcogenide (CdTe, CdSe, CdS) quantum dots (QDs) with a narrow size distribution in a colloidal dispersion using Ultraviolet-visible (UV-Vis) absorption spectroscopy. The analysis of the spheroidal particle size is applicable to the diameter range of 3,5 nm to 9 nm for CdTe, 1 nm to 8 nm for CdSe, and 1 nm to 5,5 nm for CdS and is recommended for samples with narrow size distributions.				
	ISO/TS 18827:2017	Nanotechnologies -- Electron spin resonance (ESR) as a method for measuring reactive oxygen species (ROS) generated by metal oxide nanomaterials	ISO/TS 18827:2017 provides a procedure for the detection of ROS (OH, O <sub>2</sub> <sup>-</sup> , 1O <sub>2</sub> ) generated by metal oxide nanomaterials in aqueous solution with a reactive oxygen species-specific spin trapping agent using ESR, but excludes ESR procedures that do not use a spin trapping agent.	Published		ISO/TC 229	-
	ISO/TS 19006:2016	Nanotechnologies -- 5-(and 6)-Chloromethyl-2',7' Dichloro-dihydrofluorescein diacetate (CM-H2DCF-DA)	ISO/TS 19006:2016 describes how to test and evaluate results obtained from in vitro ROS generation in RAW 264.7	Published		ISO/TC 229	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
		assay for evaluating nanoparticle-induced intracellular reactive oxygen species (ROS) production in RAW 264.7 macrophage cell line	macrophage cells exposed to nano-objects, nanoparticles, their aggregates and agglomerates using the CM-H2DCFDA assay. The protocol in ISO/TS 19006:2016 is limited to use of a 24 well plate so if other plates were to be used, volumes would need to be adjusted and the protocol steps validated to ensure confidence in the test results.				
CEN ISO/TS 19590:2019	ISO/TS 19590:2017	Nanotechnologies - Size distribution and concentration of inorganic nanoparticles in aqueous media via single particle inductively coupled plasma mass spectrometry (ISO/TS 19590:2017)	ISO/TS 19590:2017 specifies a method for the detection of nanoparticles in aqueous suspensions and characterization of the particle number and particle mass concentration and the number-based size distribution using ICP-MS in a time-resolved mode to determine the mass of individual nanoparticles and ionic concentrations. The method is applicable for the determination of the size of inorganic nanoparticles (e.g. metal and metal oxides like Au, Ag, TiO <sub>2</sub> , BVO <sub>4</sub> , etc.), with size ranges of 10 nm to 100 nm	Published	CEN/TC 352	ISO/TC 229	-

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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			(and larger particles up to 1 000 nm to 2 000 nm) in aqueous suspensions. Metal compounds other than oxides (e.g. sulfides, etc.), metal composites or coated particles with a metal core can be determined if the chemical composition and density are known. Particle number concentrations that can be determined in aqueous suspensions range from 10 <sup>6</sup> particles/L to 10 <sup>9</sup> particles/L which corresponds to mass concentrations in the range of approximately 1 ng/L to 1 000 ng/L (for 60 nm Au particles). Actual numbers depend on the type of mass spectrometer used and the type of nanoparticle analysed. In addition to the particle concentrations, ionic concentrations in the suspension can also be determined. Limits of detection are comparable with standard ICP-MS measurements. Note that nanoparticles with sizes				

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			smaller than the particle size detection limit of the splCP-MS method may be quantified as ionic. The method proposed in this document is not applicable for the detection and characterization of organic or carbon-based nanoparticles like encapsulates, fullerenes and carbon nanotubes (CNT). In addition, it is not applicable for elements other than carbon and that are difficult to determine with ICP-MS. Reference [5] gives an overview of elements that can be detected and the minimum particle sizes that can be determined with splCP-MS.				
	ISO/TS 20660:2019	Nanotechnologies -- Antibacterial silver nanoparticles -- Specification of characteristics and measurement methods	This document provides guidance for the specification of characteristics and relevant measurement methods for silver nanoparticles in powder or colloidal forms that are intended for antibacterial applications in nanotechnology. This document is intended to aid the producer in providing the physicochemical	Published		ISO/TC 229	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			characteristics of silver nanoparticles that have an antibacterial effect to the buyer. This document does not cover considerations specific to health and safety issues either during manufacturing or use.				
	ISO/TS 21361:2019	Nanotechnologies -- Method to quantify air concentrations of carbon black and amorphous silica in the nanoparticle size range in a mixed dust manufacturing environment	This document provides guidelines to quantify and identify air concentration (number of particles/cm <sup>3</sup> ) of particles of carbon black and/or amorphous silica by size in air samples collected in a mixed dust industrial manufacturing environment. The method is defined for air samples collected with an electrical low pressure cascade impactor (ELPCI). on a 25 mm polycarbonate substrate. The method is suitable for sampling in manufacturing environments where there are a variety of particle types contributing to the overall atmosphere. This method is applicable only to environments with chemically and physically distinct particles	Published		ISO/TC 229/JWG 2	-

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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			contributing to aerosols or when confounders can be controlled (e.g. diesel sources). Other sampling methods can also be suitable, though this document is limited to describing methods associated with the electrical low pressure cascade impactor. Samples collected with the electrical low pressure cascade impactor are analysed via TEM and EDS to for particle morphology and elemental composition, respectively, to permit identification of particles by type. This information is then used, in conjunction with particle concentration by size range, as determined by the electrical low pressure cascade impactor, to determine concentration of the materials of interest by size.				
	ISO/TS 21362:2018	Nanotechnologies -- Analysis of nano-objects using asymmetrical-flow and centrifugal field-flow fractionation	This document identifies parameters and conditions, as part of an integrated measurement system, necessary to develop and validate methods for the	Published		ISO/TC 229/JWG 2	-



## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			application of asymmetrical-flow and centrifugal field-flow fractionation to the analysis of nano-objects and their aggregates and agglomerates dispersed in aqueous media. In addition to constituent fractionation, analysis can include size, size distribution, concentration and material identification using one or more suitable detectors. General guidelines and procedures are provided for application, and minimal reporting requirements necessary to reproduce a method and to convey critical aspects are specified.				
00352026		Nanotechnologies - Nano- and micro-scratch testing		Under development	CEN/TC 352/WG 1		-
00352038		Nanotechnologies - Sampling for direct analysis (shape, size distribution, elemental composition)		Under development	CEN/TC 352/WG 1		-
00352043		Nanotechnologies - Guidance on the determination of aggregation and		Under development	CEN/TC 352/WG 1		-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
		agglomeration state of nano-objects					
00352044		Nanotechnologies - Guidelines for the characterization of nanoobjects-containing additives in food products		Under development	CEN/TC 352		-
CEN/TS 17010:2016		Nanotechnologies - Guidance on measurands for characterising nano-objects and materials that contain them	This Technical Specification provides guidelines 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 guidance for relevant and reliable measurement.	Published	CEN/TC 352/WG 1		-
prCEN ISO/TR 11808		Guide to nanoparticle measurement methods and their limitations		Under development	CEN/TC 352		VA/CEN Lead



**Measurement, characterization and performance evaluation: Carbon Nano Tubes (CNT)**

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
	IEC/TS 62607-2-1:2015	Nanomanufacturing - key control characteristics for CNT film applications - Resistivity -- Part 2-1:		Published		ISO/TC 229	-
	ISO/TR 10929:2012	Nanotechnologies -- Characterization of multiwall carbon nanotube (MWCNT) samples	ISO/TR 10929:2012 identifies the basic properties of multiwall carbon nanotubes (MWCNTs) and the content of impurities, which characterize bulk samples of MWCNTs, and highlights the major measurement methods available to industry for the determination of these parameters. ISO/TR 10929:2012 provides a sound basis for the research, development and commercialization of these materials.	Published		ISO/TC 229/JWG 2	FROZEN Parallel (ISO lead)
	ISO/TS 10797:2012	Nanotechnologies -- Characterization of single-wall carbon nanotubes using transmission electron microscopy	ISO/TS 10797:2012 establishes methods for characterizing the morphology of single-wall carbon nanotubes (SWCNTs) and identifying the elemental composition of other materials in SWCNT samples, using transmission electron microscopy and chemical	Published		ISO/TC 229/JWG 2	FROZEN Parallel (ISO lead)

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			analysis by energy dispersive X-ray spectrometry				
	ISO/TS 10798:2011	Nanotechnologies -- Characterisation of single-wall carbon nanotubes using scanning electron microscopy and energy dispersive X-ray spectrometry analysis	ISO/TS 10798:2011 establishes methods to characterize the morphology, and to identify the elemental composition of catalysts and other inorganic impurities in raw and purified single-wall carbon nanotube (SWCNT) powders and films, using scanning electron microscopy and energy dispersive X-ray spectrometry analysis. The methods described in ISO/TS 10798:2011 for SWCNTs can also be applied to the analysis of multiwall carbon nanotubes (MWCNTs).	Published		ISO/TC 229/JWG 2	FROZEN Parallel (ISO lead)
	ISO/TS 10867:2010	Nanotechnologies -- Characterization of single-wall carbon nanotubes using near infrared photoluminescence spectroscopy	ISO/TS 10867:2010 provides guidelines for the characterization of single-wall carbon nanotubes (SWCNTs) using near infrared (NIR) photoluminescence (PL) spectroscopy. ISO/TS 10867:2010 provides a measurement method for the determination of the chiral	Published		ISO/TC 229/JWG 2	FROZEN Parallel (ISO lead)

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			indices of the semi-conducting SWCNT in a sample and their relative integrated PL intensities. The method can be expanded to estimate relative mass concentrations of semi-conducting SWCNTs in a sample from measured integrated PL intensities and knowledge of their PL cross-sections.				
	ISO/TS 10868:2017	Nanotechnologies -- Characterization of single-wall carbon nanotubes using ultraviolet-visible-near infrared (UV-Vis-NIR) absorption spectroscopy	ISO/TS 10868:2017 provides guidelines for the characterization of compounds containing single-wall carbon nanotubes (SWCNTs) by using optical absorption spectroscopy. The aim of this document is to describe a measurement method to characterize the diameter, the purity, and the ratio of metallic SWCNTs to the total SWCNT content in the sample. The analysis of the nanotube diameter is applicable for the diameter range from 1 nm to 2 nm.	Published		ISO/TC 229/JWG 2	FROZEN Parallel (ISO lead)

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
	ISO/TS 11251:2010	Nanotechnologies -- Characterization of volatile components in single-wall carbon nanotube samples using evolved gas analysis/gas chromatograph-mass spectrometry	ISO/TS 11251:2010 specifies a method for the characterization of volatile components in single-wall carbon nanotubes (SWCNTs) samples using evolved gas analysis/gas chromatograph mass spectrometry (EGA/GCMS).	Published		ISO/TC 229/JWG 2	-
	ISO/TS 11308:2011	Nanotechnologies -- Characterization of single-wall carbon nanotubes using thermogravimetric analysis	ISO/TS 11308:2011 provides guidelines for the characterization of SWCNT-containing samples by the use of TGA, performed in an air environment. Guidance is provided on purity assessment of SWCNT samples through a quantitative measure of the non-carbon impurity (i.e. metal catalyst) level within the material.	Published		ISO/TC 229/JWG 2	-
	ISO/TS 11888:2017	Nanotechnologies -- Characterization of multiwall carbon nanotubes -- Mesoscopic shape factors	ISO/TS 11888:2017 describes methods for the characterization of mesoscopic shape factors of multiwall carbon nanotubes (MWCNTs). Techniques employed include scanning electron microscopy (SEM), transmission electron microscopy (TEM), viscometry,	Published		ISO/TC 229/JWG 2	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			and light scattering analysis. ISO/TS 11888:2017 also includes additional terms needed to define the characterization of static bending persistence length (SBPL). Measurement methods are given for the evaluation of SBPL, which generally varies from several tens of nanometres to several hundred micrometres. Well-established concepts and mathematical expressions, analogous to polymer physics, are utilized for the definition of mesoscopic shape factors of MWCNTs.				
	ISO/TS 13278:2017	Nanotechnologies -- Determination of elemental impurities in samples of carbon nanotubes using inductively coupled plasma mass spectrometry	ISO/TS 13278:2017 provides methods for the determination of residual elements other than carbon in samples of single-wall carbon nanotubes (SWCNTs) and multiwall carbon nanotubes (MWCNTs) using inductively coupled plasma mass spectrometry (ICP-MS). The purpose of this document is to provide optimized digestion and preparation procedures for	Published		ISO/TC 229	-



## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			SWCNT and MWCNT samples in order to enable accurate and quantitative determinations of elemental impurities using ICP-MS.				

## Sustainability, consumer and societal dimensions

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
CEN ISO/TS 13830:2013	ISO/TS 13830:2013	Nanotechnologies - Guidance on voluntary labelling for consumer products containing manufactured nano-objects (ISO/TS 13830:2013)	ISO/TS 13830:2013 provides guidance on the content of voluntary labels for consumer products containing manufactured nano-objects.	Published	CEN/TC 352	ISO/TC 229	VA/ISO Lead
00352047		Safe-by-Design concept dedicated for nano scale materials (MNM) and products containing nanomaterials		Under development	CEN/TC 352/WG 2		-
CEN/TS 16937:2016		Nanotechnologies - Guidance for the responsible development of nanotechnologies	This Technical Specification provides a guidance for the responsible development of nanotechnologies taking into account: - Board Accountability; - Stakeholder Involvement; - Worker Health and Safety; - Benefits to and Risks for Public Health, Safety and the Environment; - Wider Social and Ethical Implications and Impacts; - Engagement with Business Partners; - Transparency and Disclosure. NOTE 1 This Technical Specification contributes to social responsibility as defined in ISO 26000:2010. NOTE 2	Published	CEN/TC 352/WG 2		-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			Nanotechnology activities include industrial production, R&D, services, and marketing of products. This Technical Specification neither covers labelling and advertising aspects nor is it intended for certification purposes, nor does it imply any legally binding agreements. This Technical Specification intends to cover nanotechnology activities involving manufactured nanomaterials, and where relevant incidental nanomaterials.				

## Health, safety and environmental aspects

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
EN ISO 10801:2010	ISO 10801:2010	Nanotechnologies - Generation of metal nanoparticles for inhalation toxicity testing using the evaporation/condensation method (ISO 10801:2010)	ISO 10801:2010 gives requirements and recommendations for generating metal nanoparticles as aerosols suitable for inhalation toxicity testing by the evaporation/condensation method. Its application is limited to metals such as gold and silver which have been proven to generate nanoparticles suitable for inhalation toxicity testing using the technique specified.	Published	CEN/TC 352	ISO/TC 229/WG 3	VA/ISO Lead
EN ISO 10808:2010	ISO 10808:2010	Nanotechnologies - Characterization of nanoparticles in inhalation exposure chambers for inhalation toxicity testing (ISO 10808:2010)	ISO 10808:2010 specifies requirements for, and gives guidance on, the characterization of airborne nanoparticles in inhalation exposure chambers for the purpose of inhalation toxicity studies in terms of particle mass, size distribution, number concentration and composition.	Published	CEN/TC 352	ISO/TC 229/WG 3	VA/ISO Lead
EN ISO 29701:2010	ISO 29701:2010	Nanotechnologies - Endotoxin test on nanomaterial samples for in vitro systems - Limulus	ISO 29701:2010 describes the application of a test using Limulus amoebocyte lysate (LAL) reagent for the evaluation of	Published	CEN/TC 352	ISO/TC 229/WG 3	VA/ISO Lead

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
		amebocyte lysate (LAL) test (ISO 29701:2010)	nanomaterials intended for cell-based in vitro biological test systems. The test is suitable for use with nanomaterial samples dispersed in aqueous media, e.g. water, serum or reaction medium, and to such media incubated with nanomaterials for an appropriate duration at 37 °C. ISO 29701:2010 is restricted to test samples for in vitro systems, but the methods can also be adapted to nanomaterials to be administered to animals by parenteral routes.				
	ISO/AWI TR 21624	Nanotechnologies -- Considerations for in vitro studies of airborne nanomaterials		Under development		ISO/TC 229/WG 3	-
	ISO/AWI TR 22293	Evaluation of methods for assessing the release of nanomaterials from commercial, nanomaterial-containing polymer composites		Under development		ISO/TC 229/WG 3	-
	ISO/AWI TR 22455	High throughput screening method for nanoparticles toxicity using 3D cells		Under development		ISO/TC 229/WG 3	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
	ISO/AWI TR 23463	Nanotechnologies -- Characterization of carbon nanotube and carbon nanofiber aerosols in relation to inhalation toxicity tests		Under development		ISO/TC 229/WG 3	-
	ISO/AWI TS 21633	Label-free impedance technology to assess the toxicity of nanomaterials in Vitro		Under development		ISO/TC 229/WG 3	-
	ISO/AWI TS 23034	Method to estimate cellular uptake of carbon nanomaterials using optical absorption		Under development		ISO/TC 229/WG 3	-
	ISO/AWI TS 23459	Nanotechnologies -- Assessment of protein secondary structure following an interaction with nanomaterials using circular dichroism spectroscopy		Under development		ISO/TC 229/WG 3	-
	ISO/NP TS 22082	Nanotechnologies -- Toxicity assessment of nanomaterials using dechorionated zebrafish embryo		Under development		ISO/TC 229/WG 3	-
	ISO/TR 13014:2012	Nanotechnologies -- Guidance on physico-chemical characterization of engineered nanoscale materials for toxicologic assessment		Published		ISO/TC 229/WG 3	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
	ISO/TR 13014:2012/Cor 1:2012	Nanotechnologies -- Guidance on physico- chemical characterization of engineered nanoscale materials for toxicologic assessment -- Technical Corrigendum 1		Published		ISO/TC 229/WG 3	-
	ISO/TR 13121:2011	Nanotechnologies -- Nanomaterial risk evaluation	ISO/TR 13121:2011 describes a process for identifying, evaluating, addressing, making decisions about, and communicating the potential risks of developing and using manufactured nanomaterials, in order to protect the health and safety of the public, consumers, workers and the environment. ISO/TR 13121:2011 offers guidance on the information needed to make sound risk evaluations and risk management decisions, as well as how to manage in the face of incomplete or uncertain information by using reasonable assumptions and appropriate risk management practices. Further, ISO/TR 13121:2011 includes methods to update assumptions,	Published		ISO/TC 229/WG 3	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			decisions, and practices as new information becomes available, and on how to communicate information and decisions to stakeholders. ISO/TR 13121:2011 suggests methods organizations can use to be transparent and accountable in how they manage nanomaterials. It describes a process of organizing, documenting, and communicating what information organizations have about nanomaterials.				
	ISO/TR 13329:2012	Nanomaterials -- Preparation of material safety data sheet (MSDS)	ISO/TR 13329:2012 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 for chemical products containing manufactured nanomaterials. It provides supplemental guidance to ISO 11014:2009 on the preparation of SDSs generally, addressing the preparation of an SDS for	Published		ISO/TC 229	-



## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			both manufactured nanomaterials with materials and mixtures containing manufactured nanomaterials.				
	ISO/TR 16196:2016	Nanotechnologies -- Compilation and description of sample preparation and dosing methods for engineered and manufactured nanomaterials	ISO/TR 16196:2016 provides guidance regarding the preparation of nanomaterials for eco- and bio- toxicological testing. It provides guidance regarding factors pertaining to sample preparation and dose determination that might be useful in toxicological, including ecotoxicological, testing of engineered and manufactured nanoscale materials. The descriptions of sample preparation method factors for both in vitro and in vivo toxicological testing of engineered and manufactured nanoscale materials include considerations about physico- chemical properties, media, methods for transformation and accumulation studies, health effects and dosimetry. The document is not intended to be a literature review nor a thorough assessment of the quality of the methods or data	Published		ISO/TC 229	-

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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			generated. The document is intended to complement other international efforts. The focus of this document is on factors that might lead to results that are not relevant to safety evaluations. When featured, referenced methods are considered for their general interest and potential applicability. It is likely that most of the described methods are not generally applicable to all nanomaterials but they do demonstrate important factors and limitations that are common for a variety of nanomaterials.				
	ISO/TR 16197:2014	Nanotechnologies -- Compilation and description of toxicological screening methods for manufactured nanomaterials	ISO/TR 16197:2014 provides a compilation and description of in vitro and in vivo methods that can be useful for the toxicological, including ecotoxicological screening of engineered and manufactured nanomaterials. Toxicological screening tests included in ISO/TR 16197:2014 can be used for such purposes as early decision-making in research and product development,	Published		ISO/TC 229	-

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			rapid feedback on potential toxicological/safety concerns, or for the preliminary assessment of manufactured nanomaterials. ISO/TR 16197:2014 is divided between screening assays related to humans and screening assays related to the environment. A screening test is a relatively simple, inexpensive test that can be administered easily and provides an indication of potential adverse outcomes and effects on human health or the environment.				
	ISO/TR 22019:2019	Nanotechnologies -- Considerations for performing toxicokinetic studies with nanomaterials	This document describes the background and principles for toxicokinetic studies relevant for nanomaterials. Annex A shows the definitions for terminology with respect to toxicokinetics as used in OECD TG 417:2010.	Published		ISO/TC 229/WG 3	-
	ISO/TS 12901-1:2012	Nanotechnologies -- Occupational risk management applied to engineered nanomaterials -- Part 1: Principles and approaches	ISO/TS 12901:2012 provides guidance on occupational health and safety measures relating to engineered nanomaterials, including the use of engineering controls	Published		ISO/TC 229/WG 3	-

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			and appropriate personal protective equipment, guidance on dealing with spills and accidental releases, and guidance on appropriate handling of these materials during disposal. ISO/TS 12901:2012 is intended for use by competent personnel, such as health and safety managers, production managers, environmental managers, industrial/occupational hygienists and others with responsibility for the safe operation of facilities engaged in production, handling, processing and disposal of engineered nanomaterials. ISO/TS 12901:2012 is applicable to engineered materials that consist of nano-objects such as nanoparticles, nanofibres, nanotubes and nanowires, as well as aggregates and agglomerates of these materials (NOAA).				
	ISO/TS 12901-2:2014	Nanotechnologies -- Occupational risk management applied to engineered nanomaterials --	ISO/TS 12901-2:2014 describes the use of a control banding approach for controlling the risks associated with	Published		ISO/TC 229/WG 3	-

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		Part 2: Use of the control banding approach	occupational exposures to nano-objects, and their aggregates and agglomerates greater than 100 nm (NOAA), even if knowledge regarding their toxicity and quantitative exposure estimations is limited or lacking. The ultimate purpose of control banding is to control exposure in order to prevent any possible adverse effects on workers' health. The control banding tool described here is specifically designed for inhalation control. Some guidance for skin and eye protection is given in ISO/TS 12901-1. ISO/TS 12901-2:2014 is focused on intentionally produced nano-objects such as nanoparticles, nanopowders, nanofibres, nanotubes, nanowires, as well as of aggregates and agglomerates of the same. As used in ISO/TS 12901-2:2014, the term "NOAA" applies to such components, whether in their original form or incorporated in materials or preparations from which they could be				

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			released during their lifecycle. ISO/TS 12901-2:2014 is intended to help businesses and others, including research organizations engaged in the manufacturing, processing or handling of NOAA, by providing an easy-to-understand, pragmatic approach for the control of occupational exposures.				
	ISO/TS 19337:2016	Nanotechnologies -- Characteristics of working suspensions of nano-objects for in vitro assays to evaluate inherent nano-object toxicity	ISO/TS 19337:2016 describes characteristics of working suspensions of nano-objects to be considered when conducting in vitro assays to evaluate inherent nano-object toxicity. In addition, this Technical Specification identifies applicable measurement methods for these characteristics. This Technical Specification is applicable to nano-objects, and their aggregates and agglomerates greater than 100 nm. NOTE This Technical Specification intends to help clarify whether observed toxic effects come from tested nano-objects themselves or	Published		ISO/TC 229	-

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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			from other uncontrolled sources.				
	ISO/TS 20787:2017	Nanotechnologies - Aquatic toxicity assessment of manufactured nanomaterials in saltwater lakes using Artemia sp. Nauplii	ISO/TS 20787:2017 specifies a test method, aiming to maximize repeatability and reliability of testing, to determine whether MNMs are toxic to aquatic organisms, specifically Artemia sp. nauplius. ISO/TS 20787:2017 is intended to be used by ecotoxicological laboratories that are capable in the hatching and culturing of Artemia sp. and the evaluation of toxicity of nanomaterials using Artemia sp. nauplius. This method uses Artemia sp. nauplii in a simulated environment, artificial seawater, to assess effects of nanomaterials. ISO/TS 20787:2017 is applicable to MNMs that consist of nano-objects such as nanoparticles, nanopowders, nanofibres, nanotubes, nanowires, as well as aggregates and agglomerates of such MNMs.	Published		ISO/TC 229	-

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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
00352015		Nanotechnologies - Determination of hydrochemical reactivity of nano-objects for toxicity studies		Under development	CEN/TC 352		-
00352023		Manufactured nanomaterials (MNM)s in the construction industry. Guidelines for occupational risk management		Under development	CEN/TC 352/WG 3		-
00352040		Nanotechnologies - Quick start guide for deploying a relevant nano health and safety risk management		Under development	CEN/TC 352/WG 3		-
00352041		Nanotechnologies - Decision trees and flow charts towards sensible toxicity and ecotoxicity testing of engineered nanomaterials		Under development	CEN/TC 352/WG 3		-
00352046		Risk Assessment and Life Cycle Assessment of Nanomaterials: Synergistic use of data for efficient and effective evaluations		Under development	CEN/TC 352		-
CEN/TS 17273:2018		Nanotechnologies - Guidance on detection and identification of nano-objects in complex matrices	This document sets requirements for sampling and treatment of the complex matrices in order to obtain a liquid dispersion with sufficiently high concentration	Published	CEN/TC 352/WG 3		-



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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			<p>of the nano-objects of interest. This document provides guidelines for detection and identification of specific nano-objects in complex matrices, such as liquid environmental compartments, waste water and consumer products (e.g. food, cosmetics). This document requires for the identification a priori knowledge of the nature of the nano-objects like their chemical composition. The selected detection and identification methods are based on a combination of size classification and chemical composition analysis. Identification can also be supported, e.g. by additional morphology characterization. Currently only Field Flow Fractionation, Electron Microscopy and single particle Inductively Coupled Plasma – Mass Spectrometry fulfil this combination condition.</p>				

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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
CEN/TS 17274:2018		Nanotechnologies - Guidelines for determining protocols for the explosivity and flammability of powders containing nano-objects (for transport, handling and storage)	This document provides protocol guidelines for determining explosivity and flammability characteristics of powders containing manufactured nano-objects. These explosivity and flammability characteristics are needed for safety data sheets for safe storage, handling and transport of any powder. In particular, this document will provide protocol guidelines concerning: - the determination of flammability characteristics of powders containing nano-objects with regard to sensitivity to ignition sources; - the ability of a powder containing nano- objects to generate an explosive atmosphere and the assessment of its explosion characteristics. This document is not suitable for use with recognized explosives, such as gunpowder and dynamite, explosives which do not require oxygen for combustion, or substances or mixtures of substances which	Published	CEN/TC 352/WG 3		-

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			may under some circumstances behave in a similar manner. Where any doubt exists about the existence of hazard due to explosive properties, it is best to seek expert advice.				
CEN/TS 17275:2018		Nanotechnologies - Guidelines for the management and disposal of waste from the manufacturing and processing of manufactured nano-objects	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	Published	CEN/TC 352/WG 3		-

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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			materials resulting from the manufacturing and processing of MNOs.				
CEN/TS 17276:2018		Nanotechnologies - Guidelines for Life Cycle Assessment - Application of EN ISO 14044:2006 to Manufactured Nanomaterials	This document provides guidelines for application of Life Cycle Assessments (LCA) of specific relevance to manufactured nanomaterials (MNMs), including their use in other products, according to EN ISO 14044:2006. It does not cover incidental nanomaterials.	Published	CEN/TC 352/WG 3		-

**Health, safety and environmental aspects: nano-objects and their aggregates and agglomerates (NOAA)**

Other Standardisation Technical Bodies develop documents on nano-objects and their aggregates and agglomerates (NOAA). The documents related to this topic under the responsibility of CEN/TC 352 and/or ISO/TC 229 are the following:

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
	ISO 19007:2018	Nanotechnologies -- In vitro MTS assay for measuring the cytotoxic effect of nanoparticles	ISO 19007:2018 specifies a method for evaluating the effects of nano-objects and their aggregates and agglomerates (NOAA) on cellular viability using the MTS assay. The assay design includes performance requirements and control experiments to identify and manage variability in the assay results. ISO 19007:2018 is applicable to the use of a 96-well plate.	Published		ISO/TC 229	-
	ISO/TR 12885:2018	Nanotechnologies -- Health and safety practices in occupational settings	This document describes health and safety practices in occupational settings relevant to nanotechnologies. This document focuses on the occupational manufacture and use of manufactured nano-objects, and their aggregates and agglomerates greater than 100 nm (NOAAs). It does not address health and safety issues or practices associated	Published		ISO/TC 229	-

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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			with NOAAs generated by natural processes, hot processes and other standard operations which unintentionally generate NOAAs, or potential consumer exposures or uses, though some of the information in this document can be relevant to those areas.				
	ISO/TR 18637:2016	Nanotechnologies -- Overview of available frameworks for the development of occupational exposure limits and bands for nano-objects and their aggregates and agglomerates (NOAAs)	ISO/TR 16837:2016 provides an overview of available methods and procedures for the development of occupational exposure limits (OELs) and occupational exposure bands (OEBs) for manufactured nano-objects and their aggregates and agglomerates (NOAAs) for use in occupational health risk management decision-making.	Published		ISO/TC 229	-
	ISO/TR 19601:2017	Nanotechnologies -- Aerosol generation for air exposure studies of nano-objects and their aggregates and agglomerates (NOAA)	ISO/TR 19601:2017 describes methods for producing aerosols of nano-objects and their aggregates and agglomerates (NOAA) for in vivo and in vitro air exposure studies. The purpose of ISO/TR 19601:2017 is to aid in	Published		ISO/TC 229	FROZEN Parallel (ISO lead)

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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			selecting an appropriate aerosol generator to fulfil a proposed toxicology study design. ISO/TR 19601:2017 describes characteristics of aerosol generation methods, including their advantages and limitations. ISO/TR 19601:2017 does not provide guidance for aerosolization of specific nano-objects.				
	ISO/TR 21386:2019	Nanotechnologies -- Considerations for the measurement of nano-objects and their aggregates and agglomerates (NOAA) in environmental matrices	This document provides some considerations for the collection of environmental samples to be analysed for manufactured NOAA, considerations to distinguish manufactured NOAA from background levels of naturally occurring nanoscale particles of the same composition, and preparation procedures to aid in the quantification of manufactured NM in environmental matrices.	Published		ISO/TC 229/WG 3	-
00352045		Nanotechnologies - Challenges and capabilities to enhance the NOAA traceability in the B2B value		Under development	CEN/TC 352		-

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		chain for transparency and innovation purposes					



**Electrotechnical**

IEC/TC 113, Nanotechnology for electrotechnical products and systems, has developed an extensive number of deliverables. CLC/SR 113, Nanotechnology standardization for electrical and electronics products and systems, has only adopted one of its published standards, and is participating in one of its documents under development.

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
-	IEC PAS 62565-2-1:2011	Nanomanufacturing - Material specifications - Part 2-1: Single-wall carbon nanotubes - Blank detail specification	IEC/PAS 62565-2-1:2011(E) establishes a blank detail specification for the essential electrical properties and certain other common characteristics including dimensional, structural and mechanical properties of single-wall carbon nanotubes. It provides a standardized format for detail specifications characterising essential basic properties of single-wall nanotubes and recommends measurement methods. Single-wall carbon nanotubes with a chemical modification, dispersed into a solvent or grown on a substrate are included. A PAS is a technical specification not fulfilling the requirements for a standard, but made available to the public. Following publication of this PAS, which is a pre-standard publication, the	Published	-	IEC/TC 113	-

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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			technical committee concerned may transform it into an International Standard.				
-	IEC TS 62565-4-2:2018	Nanomanufacturing - Material specifications - Part 4-2: Luminescent nanomaterials - Detail specification for general lighting and display applications	IEC TS 62565-4-2:2018 specifies the essential general and optical requirements of monodisperse luminescent nanomaterials used in general lighting and display products to enable their reliable mass production and quality control during the manufacturing process. This document does not address mixtures or agglomerations of luminescent nanomaterials. In addition, this document enables the customer to specify requirements in a standardized manner and to verify through standardized methods that the luminescent nanomaterial meets the required properties.	Published	-	IEC/TC 113	-
-	IEC TS 62607-2-1:2012	Nanomanufacturing - Key control characteristics - Part 2-1: Carbon nanotube materials - Film resistance	IEC/TS 62607-2-1:2012(E) which is a technical specification, provides a standardized method for categorizing a grade of commercial carbon nanotubes in terms of their electrical	Published	-	IEC/TC 113	-

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			properties to enable a user to select a carbon nanotube material suitable for his application. The method is intended to assess whether the delivered materials from different production batches of the same production process are comparable regarding electrical properties of the final product which are related to electrical conductivity. The correlation between the measured parameters by the proposed method and a relevant product performance parameter has to be established for every application. This specification includes:- definitions of terminology used in this document, - recommendations for sample preparation,- outlines of the experimental procedures to measure sheet resistance of carbon nanotubes in thin films, - methods of interpretation of results and discussion of data analysis, - case studies and,- references.				

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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
EN 62607-3-1:2014	IEC 62607-3-1:2014	Nanomanufacturing - Key control characteristics - Part 3-1: Luminescent nanomaterials - Quantum efficiency	IEC 62607-3-1:2014 describes the procedures to be followed and precautions to be observed when performing reproducible measurements of the quantum efficiency of luminescent nanomaterials. Luminescent nanomaterials covered by this method include nano-objects such as quantum dots, nanophosphors, nanoparticles, nanofibers, nanocrystals, nanoplates, and structures containing these materials. The nanomaterials may be dispersed in either a liquid state (e.g., colloidal dispersion of quantum dots) or solid-state (e.g., nanofibers containing luminescent nanoparticles). This standard covers both relative measurements of liquid state luminescent nanomaterials and absolute measurements of both solid and liquid state nanomaterials. Key words: nanotechnology, nano, naloleds	Published	CLC/SR 113	IEC/TC 113	-

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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
-	IEC TS 62607-3-2:2017	Nanomanufacturing - Key control characteristics - Part 3-2: Luminescent nanoparticles - Determination of mass of quantum dot dispersion	IEC TS 62607-3-2:2017(E) specifies a method for determining the mass of a sample of QD dispersion after the removal of impurities and surfactant ligands through heating at high temperatures.	Published	-	IEC/TC 113	-
-	IEC TS 62607-4-1:2015	Nanomanufacturing - Key control characteristics - Part 4-1: Cathode nanomaterials for nano-enabled electrical energy storage - Electrochemical characterisation, 2-electrode cell method	IEC TS 62607-4-1:2015(E) provides a standardized method for the determination of electrochemical properties of cathode nanomaterials of, for example, lithium-ion batteries utilizing lithium iron phosphate to enable customers to decide whether or not a cathode nanomaterial is usable, and select a cathode nanomaterial suitable for their application. This second edition cancels and replaces the first edition published in 2014. This edition constitutes a technical revision.	Published	-	IEC/TC 113	-
-	IEC TS 62607-4-2:2016	Nanomanufacturing - Key control characteristics - Part 4-2: Nano-enabled electrical energy storage - Physical characterization of cathode	IEC TS 62607-4-2:2016(E), which is a Technical Specification, provides a standardized method for the determination of the density of cathode nanomaterials in	Published	-	IEC/TC 113	-

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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
		nanomaterials, density measurement	powder form used for electrical energy storage devices. This method provides users with a key control characteristic to decide whether or not a cathode nanomaterial is usable, or suitable for their application. This document includes definitions of terminology used in this document, recommendations for sample preparation, outlines of the experimental procedures used to measure cathode nanomaterial properties, methods of interpretation of results and discussion of data analysis, case studies, and references.				
-	IEC TS 62607-4-3:2015	Nanomanufacturing - Key control characteristics - Part 4-3: Nano-enabled electrical energy storage - Contact and coating resistivity measurements for nanomaterials	IEC TS 62607-4-3:2015(E) provides a standardized test method for the measurement of contact and coating resistivity of nano-enabled electrode materials. This method will enable a customer to decide whether or not a coating composite material is usable, and select best combinations of coating	Published	-	IEC/TC 113	-

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			composite material with fabrication technologies suitable for their application.				
-	IEC TS 62607-4-4:2016	Nanomanufacturing - Key control characteristics - Part 4-4: Nano-enabled electrical energy storage - Thermal characterization of nanomaterials, nail penetration method	IEC TS 62607-4-4:2016(E), which is a Technical Specification, provides a measurement method for thermal runaway quality level test for nano-enabled energy storage devices. This method uses comparative measurement to enable a manufacturer to decide whether or not the nanomaterial additives used in energy storage devices are resilient against the thermal runaway caused by a faulty or accidental low resistance connection between two or several internal points depending on the number of stacking electrode layers of the test sample. The nanomaterial additives may mix with the materials of positive and negative electrodes, electrolyte, coated on electrodes or separator. This document includes definitions	Published	-	IEC/TC 113	-

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			of terminology, test sample, puncture nail requirements, test procedures, data analysis and methods of interpretation of results and a case study. This document does not apply directly to the safety testing for energy storage device products due to complex safety design schemes embedded in these products.				
-	IEC TS 62607-4-5:2017	Nanomanufacturing - Key control characteristics - Part 4-5: Cathode nanomaterials for nano-enabled electrical energy storage - Electrochemical characterization, 3-electrode cell method 	IEC TS 62607-4-5:2017(E) provides a standardized method for the determination of electrochemical properties of cathode nanomaterials such as lithium iron phosphate (LFP) for electrical energy storage devices. This method will enable the industry to: decide whether or not a cathode nanomaterial is usable, and select a cathode nanomaterial suitable for their application. This document includes: recommendations for sample preparation, outlines of the experimental procedures used to measure cathode nanomaterial properties, methods of interpretation of	Published	-	IEC/TC 113	-



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			results and discussion of data analysis, and case studies.				
-	IEC TS 62607-4-6:2018	Nanomanufacturing - Key control characteristics - Part 4-6: Nano-enabled electrical energy storage devices - Determination of carbon content for nano electrode materials, infrared absorption method	IEC TS 62607-4-6:2018(E) provides a method for determination of carbon content of nano electrode materials by infrared absorption spectroscopy method. The method is applicable to carbon contents of mass fraction between 0,001 % and 100 %. This method will enable customers to: a) decide whether or not a nano electrode material is usable, and b) select a nano electrode material with suitable carbon content for its application. This document includes: - recommendations for sample preparation, - outlines of the experimental procedures used to measure electrode nanomaterial properties, - methods of interpretation of results and discussion of data analysis, and - case studies.	Published	-	IEC/TC 113	-

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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
-	IEC TS 62607-4-7:2018	Nanomanufacturing - Key control characteristics - Part 4-7: Nano-enabled electrical energy storage - Determination of magnetic impurities in anode nanomaterials, ICP-OES method	IEC TS 62607-4-7:2018 provides a method for the determination of magnetic impurities in anode nanomaterials for energy storage devices using an Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES), including test overview, reagents, apparatus, test procedures, test results and test report. IEC TS 62607-4-7:2018 applies to the determination of the total content of magnetic impurities (iron, cobalt, chromium, and nickel) $\geq 0,02$ mg/kg which can be attracted by magnet.	Published	-	IEC/TC 113	-
-	IEC TS 62607-5-1:2014	Nanomanufacturing - Key control characteristics - Part 5-1: Thin-film organic/nano electronic devices - Carrier transport measurements	IEC TS 62607-5-1:2014(E) provides a standardized sample structure for characterizing charge transport properties in thin-film organic/nano electronic devices and a format to report details of the structure which shall be provided with the measurement results. The standardized OTFT testing structure with a contact-area-limited doping can mitigate	Published	-	IEC/TC 113	-

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			contact resistance and enable reliable measurement of the charge carrier mobility. The purpose of this Technical Specification is to provide test sample structures for determining the intrinsic charge transport properties of organic thin-film devices. The intention is to provide reliable materials information for OTFTs and to set guidelines for making test sample structures so that materials information is clear and consistent throughout the research community and industry.				
-	IEC TS 62607-6-4:2016	Nanomanufacturing - Key control characteristics - Part 6-4: Graphene - Surface conductance measurement using resonant cavity	IEC TS 62607-6-4:2016(E) establishes a method for determining the surface conductance of two-dimensional (2D) single-layer or multi-layer atomically thin nano-carbon graphene structures. These are synthesized by chemical vapour deposition (CVD), epitaxial growth on silicon carbide (SiC), obtained from reduced graphene oxide (rGO) or mechanically exfoliated	Published	-	IEC/TC 113	-

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			from graphite. The measurements are made in an air filled standard R100 rectangular waveguide configuration, at one of the resonant frequency modes, typically at 7 GHz. Surface conductance measurement by resonant cavity involves monitoring the resonant frequency shift and change in the quality factor before and after insertion of the specimen into the cavity in a quantitative correlation with the specimen surface area. This measurement does not explicitly depend on the thickness of the nano-carbon layer. The thickness of the specimen does not need to be known, but it is assumed that the lateral dimension is uniform over the specimen area.				
-	IEC TS 62622:2012	Nanotechnologies - Description, measurement and dimensional quality parameters of artificial gratings	IEC/TS 62622:2012(E), which is a technical specification, specifies the generic terminology for the global and local quality parameters of artificial gratings, interpreted	Published	-	IEC/TC 113	-

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			in terms of deviations from nominal positions of grating features, and provides guidance on the categorization of measurement and evaluation methods for their determination. This specification is intended to facilitate communication among manufacturers, users and calibration laboratories dealing with the characterization of the dimensional quality parameters of artificial gratings used in nanotechnology. This specification supports quality assurance in the production and use of artificial gratings in different areas of application in nanotechnology. Whilst the definitions and described methods are universal to a large variety of different gratings, the focus is on one-dimensional (1D) and two-dimensional (2D) gratings.				
-	IEC 62624:2009	Test methods for measurement of electrical properties of carbon nanotubes	IEC 62624:2009(E) (IEEE 1650:2005) provides methods for the electrical characterization of carbon	Published	-	IEC/TC 113	-

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			nanotubes (CNTs). The methods will be independent of processing routes used to fabricate the CNTs.				
-	IEC TR 62632:2013	Nanoscale electrical contacts and interconnects	IEC/TR 62632:2013(E), which is a technical report, describes a variety of nanoscale contacts and nano-interconnects used in research and development and in present-day products. The intent of this technical report is to identify nanoscale contacts and nano-interconnects that will be common in products, to describe the state-of-the-art and to describe some key features and issues related to these contacts. In particular, the following aspects are discussed for each of the nanoscale contacts or nano-interconnects listed:- type and configuration of the nanoscale contacts and interconnects formed; - requirements of the nanoscale contacts and interconnects in products;- fabrication technologies, processes, and process controls used to make the	Published	-	IEC/TC 113	-

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			nanoscale contacts and interconnects; - characterization techniques used to quantify nanoscale contacts and nano-interconnects; - functionality and performance of nanoscale contacts and interconnects; - reliability of the nanoscale contacts and interconnects in products;- and expectations of when the product and the associated nanoscale contacts will reach the market. This technical report points out the positive and negative characteristics of the nanoscale contacts and interconnects in each technology or nanomaterial discussed. This information may be helpful to product designers and researchers in their efforts to bring other nano-enabled products to the market. Recommendations for the formation and use of nanoscale contacts and interconnects are also indicated. Key words:				

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			nanotechnology, nanocontact, nano-contact				
-	IEC/IEEE 62659:2015	Nanomanufacturing - Large scale manufacturing for nanoelectronics	IEC/IEEE 62659:2015(E) provides a framework for introducing nanoelectronics into large scale, high volume production in semiconductor manufacturing facilities through the incorporation of nanomaterials (e.g. carbon nanotubes, graphene, quantum dots, etc.). Since semiconductor manufacturing facilities need to incorporate practices that maintain high yields, there are very strict requirements for how manufacturing is performed. Nanomaterials represent a potential contaminant in semiconductor manufacturing facilities and need to be introduced in a structured and methodical way.	Published	-	IEC/TC 113	-
-	IEC TR 62834:2013	IEC nanoelectronics standardization roadmap	IEC/TR 62834:2013(E), which is a technical report, describes the "IEC nanoelectronics standardization roadmap". It intends to establish a common	Published	-	IEC/TC 113	-



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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			standardization strategy in the area of nano-electrotechnology. It covers the standardization plan from 2009 to 2020 for nanomaterials, nanoscale devices, and nanofabrication processes. The report starts with a situation assessment of the market, the actual technology status, and future evolution. It provides later the list of potential standards to be developed within the concerned timeframe. The goal of this technical report is to build a consensus among members of the nano-electrotechnology community on a framework leading to inputs for consideration in standards development.				
-	IEC TS 62844:2016	Guidelines for quality and risk assessment for nano-enabled electrotechnical products	IEC TS 62844:2016(E) provides a recommended methodology for identifying relevant parameters of nanomaterials as well as providing generic guidelines on implementation of quality assessment and environment/health/safety assessment for nano-	Published	-	IEC/TC 113	-

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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			enabled/nano-enhanced electrotechnical products.				
-	IEC 62860:2013	Test methods for the characterization of organic transistors and materials	IEC 62860:2013(E) covers recommended methods and standardized reporting practices for electrical characterization of printed and organic transistors. Due to the nature of printed and organic electronics, significant measurement errors can be introduced if the electrical characterization design-of-experiment is not properly addressed. This standard describes the most common sources of measurement error, particularly for high-impedance electrical measurements commonly required for printed and organic transistors. This standard also gives recommended practices in order to minimize and/or characterize the effect of measurement artifacts and other sources of error encountered while measuring	Published	-	IEC/TC 113	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			printed and organic transistors. Keywords: electrical characterization, FET, flexible electronics, high impedance, nanocomposite, nanotechnology, OFET, organic electronics, organic transistor, printed electronics, printing, transistor				
-	IEC 62860-1:2013	Test methods for the characterization of organic transistor-based ring oscillators	IEC 62860-1:2013(E) covers recommended methods and standardized reporting practices for electrical characterization of printed and organic ring oscillators. Due to the nature of printed and organic circuits, significant measurement errors can be introduced if the electrical characterization design-of-experiment is not properly addressed. This standard describes the most common sources of measurement error, particularly for high-impedance electrical measurements commonly required for printed and organic ring oscillators. This standard also gives recommended practices in	Published	-	IEC/TC 113	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			order to minimize and/or characterize the effect of measurement artifacts and other sources of error encountered while measuring printed and organic ring oscillators. Keywords: electrical characterization, high-impedance printing, organic transistor, printed electronics, ring oscillator				
-	IEC TS 62876-2-1:2018	Nanotechnology - Reliability assessment - Part 2-1: Nano-enabled photovoltaic devices - Stability test	IEC TS 62876-2-1:2018 establishes a general stability testing programme to verify the stability of the performance of nanomaterials and nano-enabled photovoltaic devices (NePV) devices. These devices are used as subassemblies for the fabrication of photovoltaic modules through a combination with other components. This testing programme defines standardized degradation conditions, methodologies and data assessment for technologies. The results of these tests define a stability under standardized	Published	-	IEC/TC 113	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			degradation conditions for quantitative evaluation of the stability of a new technology. The procedures outlined in this document were designed for NePV, but can be extended to serve as a guideline for other photovoltaic technologies as well.				
-	IEC TS 80004-9:2017	Nanotechnologies - Vocabulary - Part 9: Nano-enabled electrotechnical products and systems	IEC TS 80004-9: 2017(E) specifies terms and definitions for electrotechnical products and systems reliant on nanomaterials for their essential functionalities. It is intended to facilitate communications between organizations and individuals in industry and those who interact with them.	Published	-	IEC/TC 113	-
-	ISO TR 12802:2010	Nanotechnologies - Model taxonomic framework for use in developing vocabularies - Core concepts	ISO TR 12802:2010 establishes core concepts for nanotechnology in a model taxonomic framework. It is intended to facilitate communication and promote common understanding.	Published	-	IEC/TC 113	-
-	ISO TR 19733:2019	Nanotechnologies - Matrix of properties and measurement techniques for graphene and	ISO TR 19733:2019 This document provides a matrix which links key properties of	Published	-	IEC/TC 113	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
		related two-dimensional (2D) materials	graphene and related two-dimensional (2D) materials to commercially available measurement techniques. The matrix includes measurement techniques to characterize chemical, physical, electrical, optical, thermal and mechanical properties of graphene and related 2D materials.				
-	ISO TS 80004-1:2015	Nanotechnologies -- Vocabulary -- Part 1: Core terms	ISO TS 80004-1:2015 lists terms and definitions related to core terms in the field of nanotechnologies. It is intended to facilitate communications between organizations and individuals in industry and those who interact with them.	Published	-	IEC/TC 113	-
-	ISO TS 80004-2:2015	Nanotechnologies - Vocabulary - Part 2: Nano-objects	ISO/TS 80004-2:2015 lists terms and definitions related to particles in the field of nanotechnologies.	Published	-	IEC/TC 113	-
-	ISO TS 80004-3:2010	Nanotechnologies - Vocabulary - Part 3: Carbon nano-objects	ISO/TS 80004-3:2010 lists terms and definitions related to carbon nano-objects in the field of nanotechnologies. It is intended to facilitate communications between	Published	-	IEC/TC 113	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			organizations and individuals in industry and those who interact with them.				
-	ISO TS 80004-4:2011	Nanotechnologies - Vocabulary - Part 4: Nanostructured materials	ISO/TS 80004-4:2011 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 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. ISO/TS 80004-4:2011 includes nanodispersion.	Published	-	IEC/TC 113	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
-	ISO TS 80004-5:2011	Nanotechnologies - Vocabulary - Part 5: Nano/bio interface	ISO/TS 80004-5:2011 lists terms and definitions related to the interface between nanomaterials and biology. It is intended to facilitate communications between scientists, engineers, technologists, designers, manufacturers, regulators, NGOs, consumer organizations, members of the public and others with an interest in: - the application or use of nanotechnologies in biology or biotechnology; - the use of biological matter or principles in nanotechnology.	Published	-	IEC/TC 113	-
-	ISO TS 80004-6:2013	Nanotechnologies - Vocabulary - Part 6: Nano-object characterization	ISO/TS 80004-6:2013 lists terms and definitions relevant to the characterization of nano-objects.	Published	-	IEC/TC 113	-
-	ISO TS 80004-7:2011	Nanotechnologies - Vocabulary - Part 7: Diagnostics and therapeutics for healthcare	ISO/TS 80004-7:2011 is applicable to the use of nanotechnologies in medical diagnostics and therapeutics. Terms relating to the applications of nanotechnology in healthcare might also be addressed in other parts of ISO/TS 80004	Published	-	IEC/TC 113	-



## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			and in other documents. Terms relating to the exploitation of material features at the nanoscale for diagnostic or therapeutic purposes in relation to human disease come within the scope of ISO/TS 80004-7:2011. Nanoscale properties can be embodied in materials that contain nanoscale elements, or are themselves of nanoscale dimensions. ISO/TS 80004-7:2011 provides consistent and unambiguous use of terms for healthcare professionals, manufacturers, consumers, technologists, patent agents, regulators, NGOs, and researchers, etc.				
-	ISO TS 80004-8:2013	Nanotechnologies -- Vocabulary -- Part 8: Nanomanufacturing processes	ISO TS 80004-8:2013 gives terms and definitions related to nanomanufacturing processes in the field of nanotechnologies. It forms one part of multi-part terminology and definitions documentation covering the different aspects of nanotechnologies.	Published	-	IEC/TC 113	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
-	ISO TS 80004-11:2017	Nanotechnologies - Vocabulary - Part 11: Nanolayer, nanocoating, nanofilm, and related terms	ISO/TS 80004-11:2017 lists terms and definitions, and specifies an extensible taxonomic terminology framework for nanolayers, nanocoatings, nanofilms, and related terms in the field of nanotechnologies.	Published	-	IEC/TC 113	-
-	ISO TS 80004-12:2016	Nanotechnologies - Vocabulary - Part 12: Quantum phenomena in nanotechnology	ISO/TS 80004-12:2016 lists terms and definitions relevant to quantum phenomena in nanotechnologies. <p>All of these terms are important for nanotechnologies, but it is to be noted that many of them are not exclusively relevant to the nanoscale and can also be used to some extent to refer to larger scales.</p> <p>The list of terms presented does not claim to provide exhaustive coverage of the whole spectrum of quantum concepts and phenomena in nanotechnology. It covers important phenomena as acknowledged by many stakeholders from academia, industry, etc. ISO/TS 80004- 12:2016 is intended to facilitate communication	Published	-	IEC/TC 113	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
			between organizations and individuals in industry and those who interact with them.				
-	ISO TS 80004-13:2017	Nanotechnologies - Vocabulary - Part 13: Graphene and related two-dimensional (2D) materials	ISO/TS 80004-13:2017 lists terms and definitions for graphene and related two-dimensional (2D) materials, and includes related terms naming production methods, properties and their characterization. It is intended to facilitate communication between organizations and individuals in research, industry and other interested parties and those who interact with them.	Published	-	IEC/TC 113	-
-	PWI 113-78 ED1	IEC TS 62607-7-1: Nanomanufacturing - Key control characteristics - Part 7-1: Nano-enabled photovoltaics measurement of the electrical performance and spectral response of tandem cells	-	Under development	-	IEC/TC 113	-
-	PWI 113-93 ED1	IEC TS 62565-3-3: Nanomanufacturing - Material specifications - Part 3-3: Graphene film - Sectional	-	Under development	-	IEC/TC 113	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
		blank detail specification: Monolayer graphene					
-	PWI 113-94 ED1	IEC TS 62565-3-4: Nanomanufacturing - Material specifications - Part 3-4: Graphene film - Sectional blank detail specification: Bilayer graphene	-	Under development	-	IEC/TC 113	-
-	PWI 113-95 ED1	IEC TS 62607-6-15: Nanomanufacturing – Key control characteristics – Part 6-15: Sample preparation for the reliability test of sheet resistance and contact resistance for graphene and two-dimensional materials	-	Under development	-	IEC/TC 113	-
-	PWI 113-96 ED1	IEC/TS 62607-6-8: Nanomanufacturing - Key control Characteristics - Part 6-8: Graphene film- Sheet resistance: Four-point probe method	-	Under development	-	IEC/TC 113	-
-	PWI 113-102 ED1	IEC TS 62607-6-7: Nanomanufacturing - Key control characteristics - Determination of specific surface area of graphene materials using methylene blue adsorption method	-	Under development	-	IEC/TC 113/WG 8	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
-	PWI 113-107	IEC TS 62607-8-3: Nanomanufacturing - Key Control Characteristics - Part 8-3: Nano-enabled metal- oxide interfacial devices – Reliable test of the analog change and the fluctuation of the resistance”	-	Under development	-	IEC/TC 113	-
-	PWI 113-109	IEC TS 62607-6-17: Nanomanufacturing - Key control characteristics - Part 6-17: Graphene materials - Spatial order parameter: XRD and TE	-	Under development	-	IEC/TC 113	-
-	PWI 113-110	IEC TS 62607-6-18: Nanomanufacturing - Key control characteristics - Part 6-18: Graphene powder - Functional groups: TGA-FTIR	-	Under development	-	IEC/TC 113	-
-	PWI 113-114	IEC TS 62607-6-22: Nanomanufacturing - Key control characteristics - Part 6-22: Determination of the ash content of graphene- based materials by incineration	-	Under development	-	IEC/TC 113	-
-	PWI 113-115 ED1	IEC TS 62565-3-5: Nanomanufacturing - Material specifications - Part 3-5: Graphene - Sectional	-	Under development	-	IEC/TC 113	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
		blank detail specification for graphene powder					
-	PWI 113-118	IEC TS 62607-6-23: Nanomanufacturing - Key control characteristics - Part 6-23: Graphene film - Sheet resistance, Carrier density, Carrier mobility: Hall bar	-	Under development	-	IEC/TC 113	-
-	PWI 113-120	<p>Nanomanufacturing - Material specification – Part X-X: Nanoporous activated carbon for electrochemical capacitor - Blank detail specification</p>	-	Under development	-	IEC/TC 113	-
-	PWI 113-121	<p>Nanomanufacturing - Material specifications – Part X-Y: Nanosized silicon anode material- Blank detail specification</p>	-	Under development	-	IEC/TC 113	-
-	PWI 113-122	Nano-enabled electrical energy storage – Hybrid Supercapacitors for ISG application – Electrochemical characterisations of electrodes and modules	-	Under development	-	IEC/TC 113	-
-	PWI 113-123	<p>Nanomanufacturing - Material specification – Part X-X: Nano-enabled electrode	-	Under development	-	IEC/TC 113	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
		of electrochemical capacitor - Blank detail specification					
-	PNW TS 113-482	Nanomanufacturing – key control characteristics – Part 6-26: 2D materials – Fracture strain and stress, Young’s modulus, residual strain and stress: Bulge test	-	Under development	-	IEC/TC 113/WG 8	-
-	PNW TS 113-497	Nanomanufacturing - Key control characteristics - Part 6-12: Graphene film – Number of layers: Raman spectroscopy, optical reflection	-	Under development	-	IEC/TC 113/WG 8	-
-	IEC TS 62565-1 ED1	Nanomanufacturing - Material specifications, Part 1 - Basic concept	-	Under development	-	IEC/TC 113/PT 62565-1	-
prEN 62565-3-1	IEC 62565-3-1 ED1	Nanomanufacturing - Material specifications - Part 3-1: Graphene - Blank detail specification	-	Under development	CLC/SR 113	IEC/TC 113/JPT 62565-3-1	-
-	IEC TS 62565-3-2 ED1	IEC/TS 62565-3-2: Nanomanufacturing - Material specifications - Part 3-2: Graphene - Sectional blank detail specification for nano-ink	-	Under development	-	IEC/TC 113/WG 8	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
-	IEC TS 62565-4-1 ED1	Nanomanufacturing – Key control characteristics – Part 4-1: Luminescent nanomaterials – Blank detail specification	-	Under development	-	IEC/TC 113/WG 10	-
-	IEC TS 62607-2-2 ED1	IEC TS 62607-2-2: Nanomanufacturing - Key control Characteristics - Part 2-2: Carbon Nanotube Materials - EM Shielding Effectiveness with Near Field Probe for CNTs	-	Under development	-	IEC/TC 113/WG 8	-
-	IEC TS 62607-2-4 ED1	IEC TS 62607-2-4: Nanomanufacturing - Key control characteristics - Part 2-4: Carbon nanotube materials - Test methods for determination of resistance of individual carbon nanotubes	-	Under development	-	IEC/TC 113/PT 62607-2-4	-
-	IEC TS 62607-3-3 ED1	Nanomanufacturing–Key control characteristics–Part 3-3: Luminescent nanomaterials - Determination of fluorescence lifetime using Time Correlated Single Photon Counting (TCSPC)	-	Under development	-	IEC/TC 113/PT 62607-3-3	-



## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
-	IEC TS 62607-4-8 ED1	IEC TS 62607-4-8: Nanomanufacturing - Key control characteristics – Part 4-8: Nano-enabled electrical energy storage - Determination of water content in electrode nanomaterials, Karl Fischer method	-	Under development	-	IEC/TC 113/PT 62607-4-8	-
-	IEC TS 62607-5-2 ED1	Nanomanufacturing - Key control characteristics - Part 5-2: Thin-film organic/nano electronic devices - Measuring Alternating Current characteristics	-	Under development	-	IEC/TC 113/PT 62607-5-2	-
-	IEC TS 62607-5-3 ED1	IEC TS 62607-5-3: Nanomanufacturing – Key control characteristics - Part 5-3: Thin-film organic/nano electronic devices – Measurements of charge carrier concentration	-	Under development	-	IEC/TC 113/PT 62607-5-3	-
-	IEC TS 62607-5-4 ED1	Nanomanufacturing – Key control characteristics - Part 5-4: Energy band gap measurement of nanomaterials by electron energy loss spectroscopy (EELS)	-	Under development	-	IEC/TC 113/WG 3	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
-	IEC TS 62607-6-1 ED1	Nanomanufacturing - Key control characteristics - Part 6-1: Graphene powder – Volume resistivity: four probe method	-	Under development	-	IEC/TC 113/PT 62607-6-1	-
-	IEC TS 62607-6-2 ED1	Nanomanufacturing – Key control characteristics – Part 6-2: Graphene – Evaluation of the number of layers of graphene	-	Under development	-	IEC/TC 113/PT 62607-6-2	-
-	IEC TS 62607-6-3 ED1	Nanomanufacturing - Key control characteristics - Part 6-3: Graphene material – Domain size: Surface oxidation	-	Under development	-	IEC/TC 113/JPT 62607-6-3	-
-	IEC TS 62607-6-5 ED1	Nanomanufacturing - Key control characteristics - Part 6-5: Graphene materials - Contact and sheet resistance: Transfer length method	-	Under development	-	IEC/TC 113/PT 62607-6-5	-
-	IEC TS 62607-6-6 ED1	Nanomanufacturing - Key control characteristics - Part 6-6: Graphene - Uniformity of strain analysed by spatially-resolved Raman spectroscopy	-	Under development	-	IEC/TC 113/PT 62607-6-6	-
-	IEC TS 62607-6-9 ED1	Nanomanufacturing - Key control Characteristics - Part 6-9: Graphene - Measurement of sheet	-	Under development	-	IEC/TC 113/PT 62607-6-9	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
		resistance by the non-contact Eddy current method					
-	IEC TS 62607-6-10 ED1	IEC TS 62607-6-10: Nanomanufacturing - Key control characteristics - Part 6-10: Graphene film - Sheet resistance: Terahertz time-domain spectroscopy	-	Under development	-	IEC/TC 113/WG 8	-
-	IEC TS 62607-6-11 ED1	Nanomanufacturing - Key control characteristics - Part 6-11: Graphene film - Defect density: Raman spectroscopy	-	Under development	-	IEC/TC 113/PT 62607-6-11	-
-	IEC TS 62607-6-13 ED1	Nanomanufacturing – Key control characteristics – Part 6-13: Graphene powder - Oxygen functional groups content: Boehm titration method	-	Under development	-	IEC/TC 113/PT 62607-6-13	-
-	IEC TS 62607-6-14 ED1	Nanomanufacturing – Key control characteristics – Part 6-14: Graphene powder – Defect level: Raman spectroscopy	-	Under development	-	IEC/TC 113/PT 62607-6-14	-
-	IEC TS 62607-6-16 ED1	Nanomanufacturing – Key control characteristics – Part 6-16: Two-dimensional materials - Doping concentration: Field effect transistor method	-	Under development	-	IEC/TC 113/WG 8	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
-	IEC TS 62607-6-19 ED1	Nanomanufacturing - Key control characteristics - Part 6-19: Graphene powder - Elemental composition: CS analyser, ONH analyser	-	Under development	-	IEC/TC 113/WG 8	-
-	IEC TS 62607-6-20 ED1	Nanomanufacturing - Key control characteristics - Part 6-20: Graphene powder - Metallic impurity content: ICP-MS	-	Under development	-	IEC/TC 113/WG 8	-
-	IEC TS 62607-6-21 ED1	IEC TS 62607-6-21: Nanomanufacturing - Key control characteristics - Part 6-21: Graphene Powder – Elemental composition, C/O ratio: XPS	-	Under development	-	IEC/TC 113/WG 8	-
-	IEC TS 62607-6-25 ED1	Nanomanufacturing – Keycontrol characteristics – Part 6-25: Two-dimensional materials - Doping concentration: Kelvin Probe Force Microscopy	-	Under development	-	IEC/TC 113/WG 8	-
-	IEC TS 62607-7-2 ED1	Nanomanufacturing - Key Control Characteristics - Part 7-2: Nano-enabled photovoltaics - Device evaluation method for indoor light	-	Under development	-	IEC/TC 113/PT 62607-7-2	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
-	IEC TS 62607-8-1 ED1	IEC TS 62607-8-1: Nanomanufacturing - Key Control Characteristics - Part 8-1: Nano-enabled metal-oxide interfacial devices - Test method for defect states by thermally stimulated current	-	Under development	-	IEC/TC 113/WG 3	-
-	IEC TS 62607-8-2 ED1	IEC TS 62607-8-2: Nanomanufacturing - Key control Characteristics - Part 8-2: Nano-enabled metal-oxide interfacial devices - Test method for the polarization properties by thermally stimulated depolarization current.	-	Under development	-	IEC/TC 113/PT 62607-8-2	-
-	IEC TS 62607-9-1 ED1	Nanomanufacturing – Key control characteristics – Part 9-1: Nanoscale stray magnetic field measurements: Magnetic force microscopy	-	Under development	-	IEC/TC 113/PT 62607-9-1	-
-	IEC TR 62632/AMD1 ED1	Nanoscale electrical contacts and interconnects	-	Under development	-	IEC/TC 113/MT 62632	-
-	IEC TS 62876-3-1 ED1	Nanomanufacturing - Reliability assessment - Part 3.1: Graphene materials -	-	Under development	-	IEC/TC 113/PT 62876-3-1	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
		Stability test: Temperature and humidity					
-	IEC TR 63258 ED1	Nanotechnology: A guideline for ellipsometry application to evaluate the thickness of nanoscale films	-	Under development	-	IEC/TC 113	-
-	ISO TS 21356-1 ED1	TS 21356-1: Nanotechnologies -- Structural characterization of graphene -- Part 1: Graphene from powders and dispersions	-	Under development	-	IEC/TC 113/JWG 2	-
-	ISO TS 22292 ED1	Nanotechnologies – 3D image reconstruction of nano-objects using transmission electron microscopy	-	Under development	-	IEC/TC 113/JWG 2	-
-	ISO TS 23302 ED1	Nanotechnologies — Guidance on measurands for characterising nano-objects and materials that contain them	-	Under development	-	IEC/TC 113/JWG 2	-
-	ISO TS 80004-3 ED2	Nanotechnologies - Vocabulary - Part 3: Carbon nano-objects	-	Under development	-	IEC/TC 113/JWG 1	-
-	ISO TS 80004-4 ED2	Nanotechnologies - Vocabulary - Part 4: Nanostructured materials	-	Under development	-	IEC/TC 113/JWG 1	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)	VA
-	ISO TS 80004-6 ED2	Nanotechnologies - Vocabulary - Part 6: Nano- object characterization	-	Under development	-	IEC/TC 113/JWG 1	-
-	ISO TS 80004-8 ED2	Review report on Nanotechnologies - Vocabulary - Part 8: Nanomanufacturing processes	-	Under development	-	IEC/TC 113/JWG 1	-

### 2.5.2. Other European technical bodies developing standardisation deliverables focused on nanotechnologies

#### CEN/WS MODA, Materials modelling terminology, classification and metadata

Reference	Title	Scope	Standard Status	Drafting Body
CWA 17284:2018 <sup>41</sup>	Materials modelling - Terminology, classification and metadata	This CWA includes definitions of fundamental terms for the field of materials modelling and simulation. Computational materials models in this CWA are understood to be physics-based models. This CWA does not include data-based models. The definitions enable a classification of materials models. Using the entity and physics equation concepts, leads to a relatively small number of distinct materials models replacing the current situation of opacity of materials models and simulations that make the field hard to access for outsiders. This CWA also provides a systematic description and documentation of simulations including the user case, model, solver and post-processor: the “materials MODelling DAta” (MODA). This document seeks to organize the information so that even complex simulation workflows can be conveyed more easily and key data about the models, solvers and post-processors and their implementation can be captured. A template MODA for physics-based models is described in order to guide users towards a complete documentation of material and process simulations. The CWA is based on the Review of Materials Modelling (RoMM). A MODA for data-based models can be found in the RoMM.	Published	CEN/WS MODA

<sup>41</sup> Freely available at <ftp://ftp.cencenelec.eu/EN/ResearchInnovation/CWA/CWA1728400.pdf>



### 2.5.3. Other European technical bodies developing standardisation deliverables relevant to M/461

**CEN/TC 137, Assessment of workplace exposure to chemical and biological agents. Documents directly related to M/461 and to nanotechnologies**

Reference	Title	Scope	Standard Status	Drafting Body	Related to M/461?
EN ISO 28439:2011	Workplace atmospheres - Characterization of ultrafine aerosols/nanoaerosols - Determination of the size distribution and number concentration using differential electrical mobility analysing systems (ISO 28439:2011)	ISO 28439:2011 provides guidelines for the determination of the number concentration and size distribution of ultrafine aerosols and nanoaerosols by use of mobility particle sizers (also called differential mobility analysers). Only the particle fraction of the aerosol is considered. For ultrafine aerosols and nanoaerosols, exposure metrics such as the number and surface area concentration are important. ISO 28439:2011 also gives guidelines for the determination of workplace exposure to ultrafine aerosols and nanoaerosols. Specifically, the differential mobility analysing system (DMAS), now available from several vendors, is discussed. Principles of operation, problems of sampling in the workplace environment, calibration, equipment maintenance, measurement uncertainty, and reporting of measurement results are covered. Potential problems and limitations are described, which need to be addressed when limit values are fixed and compliance measurements carried out.	Published	CEN/TC 137/WG 3	No
EN 16897:2017	Workplace exposure - Characterization of ultrafine aerosols/nanoaerosols - Determination of number	This European Standard gives guidelines on the measurement of the fine particle fraction of the aerosol, especially for the determination of the number concentration of ultrafine aerosols and	Published	CEN/TC 137/WG 3	Yes

## OASIS

Reference	Title	Scope	Standard Status	Drafting Body	Related to M/461?
	concentration using condensation particle counters	nanoaerosols at workplaces by use of condensation particle counters (CPC). This European Standard deals with the CPC's principle of operation, problems of sampling in the workplace environment, aspects for selecting a suitable instrument, limits of application, use of different working fluids and technologies, calibration, equipment maintenance, measurement uncertainty, and reporting of measurement results. Potential problems and limitations which are of relevance for workplace measurements are described.			
EN 17058:2018	Workplace exposure - Assessment of exposure by inhalation of nano-objects and their aggregates and agglomerates	This European Standard provides guidelines to assess workplace exposure by inhalation of nano-objects and their aggregates and agglomerates (NOAA). It contains guidance on the sampling and measurement strategies to adopt and methods for data evaluation. While the focus of this document is on the assessment of nano-objects, the approach is also applicable for exposure to the associated aggregates and agglomerates, i.e. NOAA, and particles released from nanocomposites and nano-enabled products.	Published	CEN/TC 137/WG 3	Yes
CEN ISO/TS 21623:2018	Workplace exposure - Assessment of dermal exposure to nano-objects and their aggregates and agglomerates (NOAA) (ISO/TS 21623:2017)	ISO/TS 21623:2017 describes a systematic approach to assess potential occupational risks related to nano-objects and their agglomerates and aggregates (NOAA) arising from the production and use of nanomaterials and/or nano-enabled products. This approach provides guidance to identify exposure routes, exposed	Published	CEN/TC 137/WG 6	Yes

## OASIS

Reference	Title	Scope	Standard Status	Drafting Body	Related to M/461?
		body parts and potential consequences of exposure with respect to skin uptake, local effects and inadvertent ingestion. ISO/TS 21623:2017 also considers occupational use of products containing NOAA by professionals, e.g. beauticians applying personal care products, cosmetics or pharmaceuticals, but does not apply to deliberate or prescribed exposure to these products by consumers. ISO/TS 21623:2017 is aimed at occupational hygienists, researchers and other safety professionals to assist recognition of potential dermal exposure and its potential consequences.			
EN 16966:2018	Workplace exposure - Measurement of exposure by inhalation of nano-objects and their aggregates and agglomerates - Metrics to be used such as number concentration, surface area concentration and mass concentration	This European Standard specifies the use of different metrics for the measurement of exposure by inhalation of NOAA during a basic assessment and a comprehensive assessment, respectively, as described in EN 17058 [1]. This document demonstrates the implications of choice of particle metric to express the exposure by inhalation to airborne NOAA, e.g. released from nanomaterials and present the principles of operation, advantages and disadvantages of various techniques that measure the different aerosol metrics. Potential problems and limitations are described and need to be addressed when occupational exposure limit values might be adopted in the future and compliance measurements will be carried out. Specific information is mainly given for the following metrics/measurement techniques: -	Published	CEN/TC 137/WG 3	Yes

## OASIS

Reference	Title	Scope	Standard Status	Drafting Body	Related to M/461?
		Number/Condensation Particle Counters by optical detection; - Number size distribution/differential mobility analysing systems by electrical mobility; - Surface area/electrical charge on available particle surface; - Mass/chemical analyses (e.g. Inductively Coupled Plasma atomic Mass Spectrometry (ICP-MS), X-Ray Fluorescence (XRF)) on size-selective samples (e.g. by impaction or diffusion). This document is intended for those responsible for selecting measurement methods for occupational exposure to airborne NOAA.			
EN 17199-1:2019	Workplace exposure - Measurement of dustiness of bulk materials that contain or release respirable NOAA and other respirable particles - Part 1: Requirements and choice of test methods	This document provides the methodology for measuring and characterizing the dustiness of a bulk material that contains or releases respirable NOAA and other respirable particles. In addition, it specifies the environmental conditions, the sample handling procedure and the method of calculating and presenting the results. Guidance is given on the choice of method to be used. The methodology described in this document enables: a) the quantification of dustiness in terms of health related dustiness mass fractions, b) the quantification of dustiness in terms of a number-based dustiness index and a number-based emission rate, and c) the characterization of the aerosol from its particle size distribution and the morphology and chemical composition of its particles. NOTE 1 Currently, no number-based classification scheme in terms of particle number has been established for particle dustiness	Published	CEN/TC 137/WG 3	Yes

## OASIS

Reference	Title	Scope	Standard Status	Drafting Body	Related to M/461?
		release. Eventually, when a large enough number of measurement data has been obtained, the intention is to revise this document and to introduce a number-based classification scheme. This document is applicable to all bulk materials, including powders, granules or pellets, containing or releasing respirable NOAA ad other respirable particles. NOTE 2 The vortex shaker method specified in part 5 of this standard series has not yet been evaluated for pellets and granules. NOTE 3 The rotating drum and continuous drop methods have not yet been evaluated for nanofibres and nanoplates. This document does not provide methods for assessing the release of particles during handling or mechanical reduction by machining (e.g. crushing, cutting, sanding, sawing) of nanocomposites.			
EN 17199-2:2019	Workplace exposure - Measurement of dustiness of bulk materials that contain or release respirable NOAA or other respirable particles - Part 2: Rotating drum method	This document provides the methodology for measuring the dustiness of bulk materials that contain or release respirable NOAA or other respirable particles, under standard and reproducible conditions and specifies for that purpose the rotating drum method. This document specifies the selection of instruments and devices and the procedures for calculating and presenting the results. It also gives guidelines on the evaluation and reporting of the data. The methodology described in this document enables a) the measurement of the respirable, thoracic and inhalable dustiness mass fractions, b) the measurement of the number-based dustiness	Published	CEN/TC 137/WG 3	Yes

## OASIS

Reference	Title	Scope	Standard Status	Drafting Body	Related to M/461?
		<p>index of respirable particles in the particle size range from about 10 nm to about 1 µm, c) the measurement of the number-based emission rate of respirable particles in the particle size range from about 10 nm to about 1 µm, d) the measurement of the number-based particle size distribution of the released aerosol in the particle size range from about 10 nm to about 10 µm, and e) the collection of released airborne particles in the respirable fraction for subsequent observations and analysis by analytical electron microscopy. NOTE 1 The particle size range described above is based on the equipment used during the pre-normative research [4]. This document is applicable to the testing of a wide range of bulk materials including powders, granules or pellets containing or releasing respirable NOAA or other respirable particles in either unbound, bound uncoated and coated forms. NOTE 2 Currently no number-based classification scheme in terms of dustiness indices or emission rates have been established. Eventually, when a large number of measurement data has been obtained, the intention is to revise this document and to introduce such a classification scheme, if applicable. NOTE 3 The method specified in this document has not been investigated for the measurement of the dustiness of bulk materials containing nanofibres and nanoplates in terms of number-based dustiness indices or emission rates. However,</p>			

## OASIS

Reference	Title	Scope	Standard Status	Drafting Body	Related to M/461?
		there is no reason to believe that the number-based dustiness indices or emission rates could not be measured with the rotating drum method using the set-up described in this document.			
EN 17199-3:2019	Workplace exposure - Measurement of dustiness of bulk materials that contain or release respirable NOAA or other respirable particles - Part 3: Continuous drop method	This document provides the methodology for measuring the dustiness of bulk materials that contain or release respirable NOAA or other respirable particles, under standard and reproducible conditions and specifies for that purpose the continuous drop method. This document specifies the selection of instruments and devices and the procedures for calculating and presenting the results. It also gives guidelines on the evaluation and reporting of the data. The methodology described in this document enables a) the measurement of the respirable and, optionally, the inhalable dustiness mass fractions, b) the measurement of the number-based dustiness index of particles in the particle size range from about 10 nm to about 1 µm, c) the measurement of the number-based emission rate of particles in the particle size range from about 10 nm to about 1 µm, d) the measurement of the number-based particle size distribution of the released aerosol in the particle size range from about 10 nm to about 10 µm, and e) the collection of released airborne particles in the respirable dustiness mass fraction for subsequent observations and analysis by analytical electron microscopy. This document is applicable to the testing of a wide range of bulk materials including	Published	CEN/TC 137/WG 3	Yes

## OASIS

Reference	Title	Scope	Standard Status	Drafting Body	Related to M/461?
		powders, granules or pellets containing or releasing respirable NOAA or other respirable particles in either unbound, bound uncoated and coated forms. NOTE 1 Currently no number-based classification scheme in terms of dustiness indices or emission rates have been established. Eventually, when a large number of measurement data has been obtained, the intention is to revise this document and to introduce such a classification scheme, if applicable. NOTE 2 The methods specified in this document have not been evaluated for nanofibers and nanoplates.			
EN 17199-4:2019	Workplace exposure - Measurement of dustiness of bulk materials that contain or release respirable NOAA or other respirable particles - Part 4: Small rotating drum method	This document describes the methodology for measuring and characterizing the dustiness of bulk materials that contain or release respirable NOAA or other respirable particles, under standard and reproducible conditions and specifies for that purpose the small rotating drum method. This document specifies the selection of instruments and devices and the procedures for calculating and presenting the results. It also gives guidelines on the evaluation and reporting of the data. The methodology described in this document enables a) the measurement of the respirable dustiness mass fraction, b) the measurement of the number-based dustiness index of respirable particles in the particle size range from about 10 nm to about 1 µm, c) the measurement of the initial number-based emission rate and the time to reach 50 % of the total particle number released during testing, d)	Published	CEN/TC 137/WG 3	Yes



## OASIS

Reference	Title	Scope	Standard Status	Drafting Body	Related to M/461?
		<p>the measurement of the number-based particle size distribution of the released aerosol in the particle size range from about 10 nm to about 10 <math>\mu\text{m}</math>, e) the collection of released airborne particles in the respirable dustiness mass fraction for subsequent observations and analysis by analytical electron microscopy. NOTE 1 The particle size range described above is based on the equipment used during the pre-normative research [8]. This document is applicable to the testing of a wide range of bulk materials including powders, granules or pellets containing or releasing respirable NOAA or other respirable particles in either unbound, bound uncoated and coated forms. NOTE 2 Currently no number-based classification scheme in terms of particle number and emission rate has been established for powder dustiness. Eventually, when a large number of measurement data has been obtained, the intention is to revise the document and to introduce such a classification scheme, if applicable. NOTE 3 The small rotating drum method has been applied to test the dustiness of a range of materials including nanoparticle oxides, nanoflakes, organoclays, clays, carbon black, graphite, carbon nanotubes, organic pigments, and pharmaceutical active ingredients. The method has thereby been proven to enable testing of a many different materials that can contain nanomaterials as the main component.</p>			

## OASIS

Reference	Title	Scope	Standard Status	Drafting Body	Related to M/461?
EN 17199-5:2019	Workplace exposure - Measurement of dustiness of bulk materials that contain or release respirable NOAA or other respirable particles - Part 5: Vortex shaker method	This document describes the methodology for measuring and characterizing the dustiness of bulk materials that contain or release respirable NOAA or other respirable particles, under standard and reproducible conditions and specifies for that purpose the vortex shaker method. This document specifies the selection of instruments and devices and the procedures for calculating and presenting the results. It also gives guidelines on the evaluation and reporting of the data. The methodology described in this document enables a) the measurement of the respirable dustiness mass fraction, b) the measurement of the number-based dustiness index of respirable particles in the particle size range from about 10 nm to about 1 µm, c) the measurement of the number-based emission rate of respirable particles in the particle size range from about 10 nm to about 1 µm, d) the measurement of the number-based particle size distribution of the released respirable aerosol in the particle size range from about 10 nm to 10 µm, e) the collection of released airborne particles in the respirable fraction for subsequent observations and analysis by electron microscopy. This document is applicable to the testing of a wide range of bulk materials including nanomaterials in powder form. NOTE 1 With slightly different configurations of the method specified in this document, dustiness of a series of carbon nanotubes has been investigated ([5] to	Published	CEN/TC 137/WG 3	Yes

## OASIS

Reference	Title	Scope	Standard Status	Drafting Body	Related to M/461?
		<p>[10]). On the basis of this published work, it can be assumed that the vortex shaker method is also applicable to nanofibres and nanoplates. This document is not applicable to millimetre-sized granules or pellets containing nano-objects in either unbound, bound uncoated and coated forms. NOTE 2 The restrictions with regard to the application of the vortex shaker method on different kinds of nanomaterials result from the configuration of the vortex shaker apparatus as well as from the small size of the test sample required. Eventually, if future work will be able to provide accurate and repeatable data demonstrating that an extension of the method applicability is possible, the intention is to revise this document and to introduce further cases of method application. NOTE 3 As observed in the pre-normative research project [4], the vortex shaker method specified in this document provides a more energetic aerosolization than the rotating drum, the continuous drop and the small rotating drum methods specified in FprEN 17199 2 [1], FprEN 17199 3 [2] and FprEN 17199 4 [3], respectively. The vortex shaker method can better simulate high energy dust dispersion operations or processes where vibration or shaking is applied or even describe a worst case scenario in a workplace, including the (non-recommended) practice of cleaning contaminated worker coveralls and dry work surfaces with compressed air. NOTE 4 Currently no</p>			

## OASIS

Reference	Title	Scope	Standard Status	Drafting Body	Related to M/461?
		classification scheme in terms of dustiness indices or emission rates has been established according to the vortex shaker method. Eventually, when a large number of measurement data has been obtained, the intention is to revise the document and to introduce such a classification scheme, if applicable.			

**CEN/TC 137, Assessment of workplace exposure to chemical and biological agents. Documents not directly related to M/461 and to nanotechnologies**

Reference	Title	Standard Status	Drafting Body
EN 13098:2019	Workplace exposure - Measurement of airborne microorganisms and microbial compounds - General requirements	Under development	CEN/TC 137
EN 1540:2011	Workplace exposure - Terminology	Published	CEN/TC 137
EN 481:1993	Workplace atmospheres - Size fraction definitions for measurement of airborne particles	Published	CEN/TC 137
EN 689:2018+AC:2019	Workplace exposure - Measurement of exposure by inhalation to chemical agents - Strategy for testing compliance with occupational exposure limit values	Published	CEN/TC 137
EN ISO 13137:2013	Workplace atmospheres - Pumps for personal sampling of chemical and biological agents - Requirements and test methods (ISO 13137:2013)	Published	CEN/TC 137
EN ISO 13138:2012	Air quality - Sampling conventions for airborne particle deposition in the human respiratory system (ISO 13138:2012)	Published	CEN/TC 137
EN ISO 17621:2015	Workplace atmospheres - Short term detector tube measurement systems - Requirements and test methods (ISO 17621:2015)	Published	CEN/TC 137
EN ISO 22065:2019	Workplace air - Gases and vapours - Requirements for evaluation of measuring procedures using pumped samplers (ISO 22065:2019)	Published	CEN/TC 137

Reference	Title	Standard Status	Drafting Body
prEN 14583 rev	Workplace exposure - Volumetric bioaerosol sampling devices - Requirements and test methods	Under development	CEN/TC 137
prEN 1540 rev	Workplace exposure - Terminology	Under development	CEN/TC 137
CEN/TR 17055:2017	Workplace exposure - Measurement of chemical agents complying with the requirements given in EN 482 and either one of EN 838, EN 1076, EN 13205, EN 13890 and EN 13936 - Choice of procedures	Published	CEN/TC 137/WG 2
EN 13890:2009	Workplace exposure - Procedures for measuring metals and metalloids in airborne particles - Requirements and test methods	Published	CEN/TC 137/WG 2
EN 13936:2014	Workplace exposure - Procedures for measuring a chemical agent present as a mixture of airborne particles and vapour - Requirements and test methods	Published	CEN/TC 137/WG 2
EN 14530:2004	Workplace atmospheres - Determination of diesel particulate matter - General requirements	Published	CEN/TC 137/WG 2
EN 482:2012+A1:2015	Workplace exposure - General requirements for the performance of procedures for the measurement of chemical agents	Published	CEN/TC 137/WG 2
EN 838:2010	Workplace exposure - Procedures for measuring gases and vapours using diffusive samplers - Requirements and test methods	Published	CEN/TC 137/WG 2
prEN 482 rev	Workplace exposure - General requirements for the performance of procedures for the measurement of chemical agents	Under development	CEN/TC 137/WG 2

Reference	Title	Standard Status	Drafting Body
prEN ISO 21832	Workplace air - Metals and metalloids in airborne particles - Requirements for evaluation of measuring procedures	Under development	CEN/TC 137/WG 2
CEN/TR 13205-3:2014	Workplace exposure - Assessment of sampler performance for measurement of airborne particle concentrations - Part 3: Analysis of sampling efficiency data	Published	CEN/TC 137/WG 3
CEN/TR 15230:2005	Workplace atmospheres - Guidance for sampling of inhalable, thoracic and respirable aerosol fractions	Published	CEN/TC 137/WG 3
CEN/TR 15547:2007	Workplace atmospheres - Calculation of the health-related aerosol fraction concentration from the concentration measured by a sampler with known performance characteristics	Published	CEN/TC 137/WG 3
CEN/TR 16013-1:2010	Workplace exposure - Guide for the use of direct-reading instruments for aerosol monitoring - Part 1: Choice of monitor for specific applications	Published	CEN/TC 137/WG 3
CEN/TR 16013-2:2010	Workplace exposure - Guide for the use of direct-reading instruments for aerosol monitoring - Part 2: Evaluation of airborne particle concentrations using Optical Particle Counters	Published	CEN/TC 137/WG 3
CEN/TR 16013-3:2012	Workplace exposure - Guide for the use of direct-reading instruments for aerosol monitoring - Part 3: Evaluation of airborne particle concentrations using photometers	Published	CEN/TC 137/WG 3
EN 13205-1:2014	Workplace exposure - Assessment of sampler performance for measurement of airborne particle concentrations - Part 1: General requirements	Published	CEN/TC 137/WG 3
EN 13205-2:2014	Workplace exposure - Assessment of sampler performance for measurement of airborne particle concentrations - Part 2: Laboratory performance test based on determination of sampling efficiency	Published	CEN/TC 137/WG 3

Reference	Title	Standard Status	Drafting Body
EN 13205-4:2014	Workplace exposure - Assessment of sampler performance for measurement of airborne particle concentrations - Part 4: Laboratory performance test based on comparison of concentrations	Published	CEN/TC 137/WG 3
EN 13205-5:2014	Workplace exposure - Assessment of sampler performance for measurement of airborne particle concentrations - Part 5: Aerosol sampler performance test and sampler comparison carried out at workplaces	Published	CEN/TC 137/WG 3
EN 13205-6:2014	Workplace exposure - Assessment of sampler performance for measurement of airborne particle concentrations - Part 6: Transport and handling tests	Published	CEN/TC 137/WG 3
EN 15051-1:2013	Workplace exposure - Measurement of the dustiness of bulk materials - Part 1: Requirements and choice of test methods	Published	CEN/TC 137/WG 3
EN 15051-2:2013+A1:2016	Workplace exposure - Measurement of the dustiness of bulk materials - Part 2: Rotating drum method	Published	CEN/TC 137/WG 3
EN 15051-3:2013	Workplace exposure - Measurement of the dustiness of bulk materials - Part 3: Continuous drop method	Published	CEN/TC 137/WG 3
prEN 17289-1	Characterization of bulk materials - Determination of a sizeweighted fine fraction and crystalline silica content - Part 1: General information and choice of test methods	Under development	CEN/TC 137/WG 3
prEN 17289-2	Characterization of bulk materials - Determination of a sizeweighted fine fraction and crystalline silica content - Part 2: Calculation method	Under development	CEN/TC 137/WG 3
prEN 17289-3	Characterization of bulk materials - Determination of a sizeweighted fine fraction and crystalline silica content - Part 3: Sedimentation method	Under development	CEN/TC 137/WG 3



Reference	Title	Standard Status	Drafting Body
EN 13098:2000	Workplace atmosphere - Guidelines for measurement of airborne micro-organisms and endotoxin	Published	CEN/TC 137/WG 5
EN 14031:2003	Workplace atmospheres - Determination of airborne endotoxins	Published	CEN/TC 137/WG 5
EN 14583:2004	Workplace atmospheres - Volumetric bioaerosol sampling devices - Requirements and test methods	Published	CEN/TC 137/WG 5
prEN 14031 rev	Workplace exposure - Determination of airborne endotoxins (Revision of EN 14031:2003)	Under development	CEN/TC 137/WG 5
CEN/TR 15278:2006	Workplace exposure - Strategy for the evaluation of dermal exposure	Published	CEN/TC 137/WG 6
CEN/TS 15279:2006	Workplace exposure - Measurement of dermal exposure - Principles and methods	Published	CEN/TC 137/WG 6

**CEN/TC 195, Air filters for general air cleaning. Documents directly related to M/461 and to nanotechnologies**

Reference	Title	Scope	Standard Status	Drafting Body	Related to M/461?
EN ISO 21083-1:2018	Test method to measure the efficiency of air filtration media against spherical nanomaterials - Part 1: Size range from 20 nm to 500 nm (ISO 21083-1:2018)	This document specifies the testing instruments and procedure for determining the fractional filtration efficiencies of flat sheet filter medium against airborne nanoparticles in the range of 20 nm to 500 nm. The testing methods in this document are limited to spherical or nearly-spherical particles to avoid uncertainties due to the particle shape.	Published	CEN/TC 195/WG 6	Yes
CEN ISO/TS 21083-2:2019	Test method to measure the efficiency of air filtration media against spherical nanomaterials - Part 2: Size range from 3 nm to 30 nm (ISO/TS 21083-2:2019)	This document specifies the testing instruments and procedure for determining the filtration efficiencies of flat sheet filter media against airborne nanoparticles in the range of 3 nm to 30 nm. The testing methods in this document are limited to spherical or nearly-spherical particles to avoid uncertainties due to the particle shape.	Published	CEN/TC 195/WG 6	Yes

**CEN/TC 195, Air filters for general air cleaning. Documents not directly related to M/461 and to nanotechnologies**

Reference	Title	Standard Status	Drafting Body
EN 14799:2007	Air filters for general air cleaning - Terminology	Published	CEN/TC 195/WG 3
EN 15805:2009	Particulate air filters for general ventilation - Standardised dimensions	Published	CEN/TC 195/WG 1
EN 1822-1:2019	High efficiency air filters (EPA, HEPA and ULPA) - Part 1: Classification, performance testing, marking	Published	CEN/TC 195/WG 2
EN ISO 10121-1:2014	Test method for assessing the performance of gas-phase air cleaning media and devices for general ventilation - Part 1: Gas-phase air cleaning media (ISO 10121-1:2014)	Published	CEN/TC 195/WG 5
EN ISO 10121-2:2013	Test methods for assessing the performance of gas-phase air cleaning media and devices for general ventilation - Part 2: Gas-phase air cleaning devices (GPACD) (ISO 10121-2:2013)	Published	CEN/TC 195/WG 5
EN ISO 15858:2016	UV-C Devices - Safety information - Permissible human exposure (ISO 15858:2016)	Published	CEN/TC 195/WG 1
EN ISO 15957:2015	Test dusts for evaluating air cleaning equipment (ISO 15957:2015)	Published	CEN/TC 195/WG 1
EN ISO 16170:2016	In situ test methods for high efficiency filter systems in industrial facilities (ISO 16170:2016, Corrected version 2017-04)	Published	CEN/TC 195/WG 2

Reference	Title	Standard Status	Drafting Body
EN ISO 16890-1:2016	Air filters for general ventilation - Part 1: Technical specifications, requirements and classification system based upon particulate matter efficiency (ePM) (ISO 16890-1:2016)	Published	CEN/TC 195/WG 1
EN ISO 16890-2:2016	Air filters for general ventilation - Part 2: Measurement of fractional efficiency and air flow resistance (ISO 16890-2:2016)	Published	CEN/TC 195/WG 1
EN ISO 16890-3:2016	Air filters for general ventilation - Part 3: Determination of the gravimetric efficiency and the air flow resistance versus the mass of test dust captured (ISO 16890-3:2016)	Published	CEN/TC 195/WG 1
EN ISO 16890-4:2016	Air filters for general ventilation - Part 4: Conditioning method to determine the minimum fractional test efficiency (ISO 16890-4:2016)	Published	CEN/TC 195/WG 1
EN ISO 16891:2016	Test methods for evaluating degradation of characteristics of cleanable filter media (ISO 16891:2016)	Published	CEN/TC 195/WG 1
EN ISO 29461-1:2013	Air intake filter systems for rotary machinery - Test methods - Part 1: Static filter elements (ISO 29461-1:2013)	Published	CEN/TC 195/WG 1
EN ISO 29462:2013	Field testing of general ventilation filtration devices and systems for in situ removal efficiency by particle size and resistance to airflow (ISO 29462:2013)	Published	CEN/TC 195/WG 1
EN ISO 29463-2:2018	High-efficiency filters and filter media for removing particles in air - Part 2: Aerosol production, measuring equipment and particle-counting statistics (ISO 29463-2:2011)	Published	CEN/TC 195/WG 2
EN ISO 29463-3:2018	High-efficiency filters and filter media for removing particles in air - Part 3: Testing flat sheet filter media (ISO 29463-3:2011)	Published	CEN/TC 195/WG 2

Reference	Title	Standard Status	Drafting Body
EN ISO 29463-4:2018	High-efficiency filters and filter media for removing particles in air - Part 4: Test method for determining leakage of filter elements-Scan method (ISO 29463-4:2011)	Published	CEN/TC 195/WG 2
EN ISO 29463-5:2018	High-efficiency filters and filter media for removing particles in air - Part 5: Test method for filter elements (ISO 29463-5:2011)	Published	CEN/TC 195/WG 2
prEN 15805 rev	Particulate air filters for general ventilation - Standardised dimensions	Under development	CEN/TC 195
prEN ISO 12249-2	Particulate air filters for general ventilation - Part 2: Method of calculation for the energy performance of air cleaning devices and for the classification of the energy performance	Under development	CEN/TC 195/WG 1
prEN ISO 29461-1 rev	Air intake filter systems for rotary machinery - Test methods - Part 1: Static filter elements	Under development	CEN/TC 195/WG 1
prEN ISO 29461-2	Air filter intake systems for rotary machinery -- Test methods -- Part 2: Cleanable (Pulse jet) air filters	Under development	CEN/TC 195/WG 1
prEN ISO 29463-5 rev	ISO 29463-5 High-efficiency filters and filter media for removing particles in air - Part 5: Test method for filter elements	Under development	CEN/TC 195/WG 2
prEN ISO 29464	Cleaning of air and other gases - Terminology (ISO 29464:2017)	Under development	CEN/TC 195

#### 2.5.4. Other European technical bodies developing standardisation deliverables relevant to nanotechnologies

The following tables lists standardisation deliverables developed by CEN/248/WG 26, Textiles -Test methods for analysis of EC restricted substances, CEN/TC 264, Air quality, CEN/TC 298, Pigments and extenders, CEN/TC 430, Nuclear energy, nuclear technologies, and radiological protection, CEN/TC 459/SC 1, Test methods for steel (other than chemical analysis), CLC/SR 47F, Micro-electromechanical systems and CLC/SR 68, Magnetic alloys and steels.

Reference	Title	Scope	Standard Status	Drafting Body
CEN/TR 17222:2019	Textile products and nanotechnologies - Guidance on tests to simulate nanoparticle release - Skin exposure	The effects of synthetic nanoparticles on human health and the environment are still poorly understood and therefore uncertain. In particular, it is unclear in which areas nanoparticles-dose caused negative effects in the organism or in the environment (unknown dose-response relationship). The underlying toxicological mechanisms and possible effects of nanoparticle exposure over long periods of time are poorly understood. In product advertisements on the Internet and in reports in international journals, especially the functional properties of "nanotextiles" are described. The type of integration of the nanoparticles in textiles is often described only sparsely. Therefore, the present document is based primarily on research studies that include information on the integration of the nanoparticles in the textile material. The purpose of the present document is to give some guidance on tests to nanoparticle release. The determination of the release of nanoparticles could be performed either through quantification by chemical analysis (5.1), or by determining the linting (5.2), for example.	Published	CEN/TC 248/WG 26
EN ISO 16017-2:2003	Indoor, ambient and workplace air - Sampling and analysis of volatile organic compounds by sorbent tube/thermal desorption/capillary gas chromatography - Part 2:	ISO 16017-2:2003 gives general guidance for the sampling and analysis of volatile organic compounds (VOCs) in air. It is applicable to indoor, ambient and workplace air. ISO 16017-2:2003 is applicable to a wide range of VOCs, including hydrocarbons, halogenated hydrocarbons, ester, glycol	Published	CEN/TC 264

## OASIS

Reference	Title	Scope	Standard Status	Drafting Body
	Diffusive sampling (ISO 16017-2:2003)	ethers, ketones and alcohols. A number of sorbents are recommended for the sampling of these VOCs, each sorbent having a different range of applicability. Very polar compounds generally require derivatisation; very low boiling compounds are only partially retained by the sorbents and can only be estimated qualitatively. Semi-volatile compounds are fully retained by the sorbents, but may only be partially recovered. ISO 16017-2:2003 is applicable to the measurement of airborne vapours of VOCs in a concentration range of approximately 0,002 mg/m <sup>3</sup> to 100 mg/m <sup>3</sup> individual organic for an exposure time of 8 h, or 0,3 g/m <sup>3</sup> to 300 g/m <sup>3</sup> individual organic for an exposure time of four weeks. The upper limit of the useful range is set by the sorptive capacity of the sorbent used and by the linear dynamic range of the gas chromatograph column and detector or by the sample splitting capability of the analytical instrumentation used. The lower limit of the useful range depends on the noise level of the detector and on blank levels of analyte and/or interfering artefacts on the sorbent tubes. Artefacts are typically sub-nanogram for well-conditioned Tenax GR and carbonaceous sorbents, carbonized molecular sieves and pure charcoals; at low nanogram levels for Tenax TA and at 5 ng to 50 ng levels for other porous polymers.		
EN ISO 18473-1:2018	Functional pigments and extenders for special applications - Part 1: Nanoscale calcium carbonate for sealant application (ISO 18473-1:2015)	ISO 18473-1:2015 specifies requirements and corresponding methods of test for surface treated nanoscale calcium carbonate in powder form for sealant application.	Published	CEN/TC 298

## OASIS

Reference	Title	Scope	Standard Status	Drafting Body
EN ISO 18473-2:2018	Functional pigments and extenders for special applications - Part 2: Nanoscale titanium dioxide for sunscreen application (ISO 18473-2:2015)	ISO 18473-2:2015 specifies requirements and corresponding methods of test for nanoscale titanium dioxide in powder form for sunscreen application. This part of ISO 18473 covers the surface modified, TiO <sub>2</sub> .	Published	CEN/TC 298
EN ISO 15366-2:2016	Nuclear fuel technology - Chemical separation and purification of uranium and plutonium in nitric acid solutions for isotopic and isotopic dilution analysis by solvent extraction chromatography - Part 2: Samples containing plutonium and uranium in the nanogram range and below (ISO 15366-2:2014)	ISO 15366-2:2014 describes procedures to chemically separate and purify uranium and plutonium in dissolved solutions of irradiated light water reactor fuels and in samples of high active liquid waste of spent fuel reprocessing plants, prior to their isotopic analysis by e.g. mass spectrometric method or alpha spectrometry. ISO 15366-2:2014 describes a slightly different separation technique from ISO 15366-1, based on the same chemistry, using smaller columns, different support material and special purification steps, applicable to samples containing plutonium and uranium amounts in the nanogram range and below. The detection limits were found to be 500 pg plutonium and 500 pg uranium.	Published	CEN/TC 430
EN ISO 14577-1:2015	Metallic materials - Instrumented indentation test for hardness and materials parameters - Part 1: Test method (ISO 14577-1:2015)	ISO 14577-1:2015 specifies the method of instrumented indentation test for determination of hardness and other materials parameters for the following three ranges: macro range: $2 \text{ N} \leq F \leq 30 \text{ kN}$ ; micro range: $2 \text{ N} > F$ ; $h > 0,2 \text{ }\mu\text{m}$ ; and nano range: $h \leq 0,2 \text{ }\mu\text{m}$ . For the nano range, the mechanical deformation strongly depends on the real shape of indenter tip and the calculated material parameters are significantly influenced by the contact area function of the indenter used in the testing machine. Therefore, careful calibration of both instrument and indenter shape is required in order to achieve an acceptable reproducibility of the materials parameters determined with different machines. The macro	Published	CEN/TC 459/SC 1



## OASIS

Reference	Title	Scope	Standard Status	Drafting Body
		and micro ranges are distinguished by the test forces in relation to the indentation depth. Attention is drawn to the fact that the micro range has an upper limit given by the test force (2 N) and a lower limit given by the indentation depth of 0,2 µm. The determination of hardness and other material parameters is given in Annex A. At high contact pressures, damage to the indenter is possible. For this reason, in the macro range, hardmetal indenters are often used. For test pieces with very high hardness and modulus of elasticity, permanent indenter deformation can occur and can be detected using suitable reference materials. It is necessary that its influence on the test result be taken into account. This test method can also be applied to thin metallic and non-metallic coatings and non-metallic materials. In this case, it is recommended that the specifications in the relevant standards be taken into account (see also 6.3 and ISO 14577-4).		
EN ISO 14577-4:2016	Metallic materials - Instrumented indentation test for hardness and materials parameters - Part 4: Test method for metallic and non-metallic coatings (ISO 14577-4:2016)	ISO 14577-4:2016 specifies a method for testing coatings which is particularly suitable for testing in the nano/micro range applicable to thin coatings. However, the application of this method of this part of ISO 14577 is not needed if the indentation depth is such a small fraction of the coating thickness that in any possible case a substrate influence can be neglected and the coating can be considered as a bulk material. Limits for such cases are given. This test method is limited to the examination of single layers when the indentation is carried out normal to the test piece surface, but graded and multilayer coatings can also be measured in cross-section if the thickness of the individual layers or gradations is greater than the spatial resolution of the indentation process. The test method is not limited to any	Published	CEN/TC 459/SC 1

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Reference	Title	Scope	Standard Status	Drafting Body
		particular type of material. Metallic and non-metallic coatings are included in the scope of this part of ISO 14577. In this part of ISO 14577, the term coating is used to refer to any solid layer with homogeneous properties different to that of a substrate it is connected to. The method assumes that coating properties are constant with indentation depth. Composite coatings are considered to be homogenous if the structure size is less than the indentation size. The application of this part of ISO 14577 regarding measurement of indentation hardness is only possible if the indenter is a pyramid or a cone with a radius of tip curvature small enough for plastic deformation to occur within the coating. The hardness of visco-elastic materials or materials exhibiting significant creep will be strongly affected by the time taken to perform the test.		
EN 62047-17:2015	Semiconductor devices - Micro-electromechanical devices - Part 17: Bulge test method for measuring mechanical properties of thin films	IEC 62047-17:2015 specifies the method for performing bulge tests on the free-standing film that is bulged within a window. The specimen is fabricated with micro/nano structural film materials, including metal, ceramic and polymer films, for MEMS, micromachines and others. The thickness of the film is in the range of 0,1 $\mu$ to 10 $\mu$ , and the width of the rectangular and square membrane window and the diameter of the circular membrane range from 0,5 mm to 4 mm. The tests are carried out at ambient temperature, by applying a uniformly-distributed pressure to the testing film specimen with bulging window. Elastic modulus and residual stress for the film materials can be determined with this method.	Published	CLC/SR 47F

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Reference	Title	Scope	Standard Status	Drafting Body
EN IEC 60404-6:2018	Magnetic materials - Part 6: Methods of measurement of the magnetic properties of magnetically soft metallic and powder materials at frequencies in the range 20 Hz to 100 kHz by the use of ring specimens	IEC 60404-6:2018 specifies methods for the measurement of AC magnetic properties of soft magnetic materials, other than electrical steels and soft ferrites, in the frequency range 20 Hz to 100 kHz. The materials covered by this part of IEC 60404 include those speciality alloys listed in IEC 60404-8-6, amorphous and nano-crystalline soft magnetic materials, pressed and sintered and metal injection moulded parts such as are listed in IEC 60404-8-9, cast parts and magnetically soft composite materials. The object of this part is to define the general principles and the technical details of the measurement of the magnetic properties of magnetically soft materials by means of ring methods. For materials supplied in powder form, a ring test specimen is formed by the appropriate pressing method for that material. The measurement of the DC magnetic properties of soft magnetic materials is made in accordance with the ring method of IEC 60404-4. The determinations of the magnetic characteristics of magnetically soft components are made in accordance with IEC 62044-3. This edition includes the following significant technical changes with respect to the previous edition: a) adaption to modern measurement and evaluation methods, in particular the introduction of the widely spread digital sampling method for the acquisition and evaluation of the measured data; b) limitation of the frequency range up to 100 kHz; c) deletion of Clause 7 of the second edition that specified the measurement of magnetic properties using a digital impedance bridge; d) addition of a new Clause 7 on the measurement of the specific total loss by the wattmeter method, including an example of the application of the digital sampling method; e) addition of an informative annex on the technical details of the digital	Published	CLC/SR 68

## OASIS

Reference	Title	Scope	Standard Status	Drafting Body
		sampling technique for the determination of magnetic properties.		
prEN 60404-7:2018	Magnetic materials - Part 7: Method of measurement of the coercivity (up to 160 kA/m) of magnetic materials in an open magnetic circuit	This part of IEC 60404 specifies a method of measurement of the coercivity of magnetic materials in an open magnetic circuit. This document is applicable to all magnetic materials with coercivities from 0,2 A/m to 160 kA/m. NOTE Examples of magnetic materials covered by this document are amorphous alloys, nanocrystalline alloys, all softmagnetic crystalline materials (e.g. Fe, FeSi-, CoFe- and FeNi-alloys), soft ferrites, hard metals, semi-hard magnetic alloys (e.g. FeCoTiAl-, FeCoV-, FeCrCo- and AlNiCo-alloys) [1]1. Special precautions are to be taken in measuring coercivities below 40 A/m, in materials with high conductivity and in test specimens which have a shape different from ellipsoids (see Annex A).	Under development	CLC/SR 68

### 2.5.5. Other Standardisation Technical Bodies relevant to nanotechnologies

#### Technical Committee E56 on Nanotechnology of ASTM International

Reference	Title	Standard Status	Drafting Body
E2456-06(2012)	Standard Terminology Relating to Nanotechnology	Published	E56.01: Informatics and Terminology
E2909-13	Standard Guide for Investigation/Study/Assay Tab-Delimited Format for Nanotechnologies (ISA-TAB-Nano): Standard File Format for the Submission and Exchange of Data on Nanomaterials and Characterizations	Published	E56.01: Informatics and Terminology
E3172-18	Standard Guide for Reporting Production Information and Data for Nano-Objects	Published	E56.01: Informatics and Terminology
WK59121	New Guide for An Extensible Nanoparticle Ontology	Under development	E56.01: Informatics and Terminology
WK58112	New Guide for Reporting the Physical and Chemical Characteristics of Nano-objects	Under development	E56.01: Informatics and Terminology
WK62977	New Guide for Reporting the Physical and Chemical Characteristics of Collections of Nanoobjects	Under development	E56.01: Informatics and Terminology
E2490-09(2015)	Standard Guide for Measurement of Particle Size Distribution of Nanomaterials in Suspension by Photon Correlation Spectroscopy (PCS)	Published	E56.02: Physical and Chemical Characterization
E2578-07(2018)	Standard Practice for Calculation of Mean Sizes/Diameters and Standard Deviations of Particle Size Distributions	Published	E56.02: Physical and Chemical Characterization

Reference	Title	Standard Status	Drafting Body
E2834-12	Standard Guide for Measurement of Particle Size Distribution of Nanomaterials in Suspension by Nanoparticle Tracking Analysis (NTA)	Published	E56.02: Physical and Chemical Characterization
E2859-11	Standard Guide for Size Measurement of Nanoparticles Using Atomic Force Microscopy	Published	E56.02: Physical and Chemical Characterization
E2864-13	Standard Test Method for Measurement of Airborne Metal Oxide Nanoparticle Surface Area Concentration in Inhalation Exposure Chambers using Krypton Gas Adsorption	Published	E56.02: Physical and Chemical Characterization
E2865-12	Standard Guide for Measurement of Electrophoretic Mobility and Zeta Potential of Nanosized Biological Materials	Published	E56.02: Physical and Chemical Characterization
E3143-18a	Standard Practice for Performing Cryo-Transmission Electron Microscopy of Liposomes	Published	E56.02: Physical and Chemical Characterization
WK54872	New Test Method for Measuring the Size of Nanoparticles in Aqueous Media Using BatchMode Dynamic Light Scattering	Under development	E56.02: Physical and Chemical Characterization
WK56764	New Guide for Characterization of Graphene Flakes Produced by Exfoliation - Technical	Under development	E56.02: Physical and Chemical Characterization
WK54613	New Guide for the Analysis of Nanoparticles by Single Particle Inductively Coupled Plasma Mass Spectrometry (SP-ICP-MS)	Under development	E56.02: Physical and Chemical Characterization
-	New Test Method for the Determination of the Mass Fraction of Particle-Bound Gold in Gold Nanoparticle Suspensions	Under development	E56.02: Physical and Chemical Characterization

Reference	Title	Standard Status	Drafting Body
-	New Test Method for the Determination of Gold Mass fraction in Blood by Inductively Coupled Plasma Mass Spectrometry	Under development	E56.02: Physical and Chemical Characterization
E2524-08(2013)	Standard Test Method for Analysis of Hemolytic Properties of Nanoparticles	Published	E56.03: Environment, Health, and Safety
E2525-08(2013)	Standard Test Method for Evaluation of the Effect of Nanoparticulate Materials on the Formation of Mouse Granulocyte-Macrophage Colonies	Published	E56.03: Environment, Health, and Safety
E2526-08(2013)	Standard Test Method for Evaluation of Cytotoxicity of Nanoparticulate Materials in Porcine Kidney Cells and Human Hepatocarcinoma Cells	Published	E56.03: Environment, Health, and Safety
E2535-07(2013)	Standard Guide for Handling Unbound Engineered Nanoscale Particles in Occupational Settings	Published	E56.03: Environment, Health, and Safety
WK48313	New Guide for Collection and Generation of Environment, Health, and Safety Information for Nanomaterials and Nano-enabled Products	Under development	E56.03: Environment, Health, and Safety
E3025-2016	Standard Guide for Tiered Approach to Detection and Characterization of Silver Nanomaterials in Textiles	Published	E56.06: Nano-Enabled Consumer Products
WK52417	New Test Method for Determination of Total Silver in Textiles by Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) or Inductively Coupled Plasma Mass Spectrometry (ICP MS) Analysis	Under development	E56.06: Nano-Enabled Consumer Products
E2996-15	Standard Guide for Nanotechnology Workforce Education in Health and Safety	Published	E56.07: Education and Workforce Development

Reference	Title	Standard Status	Drafting Body
E3001-15	Standard Practice for Workforce Education in Nanotechnology Characterization	Published	E56.07: Education and Workforce Development
E3034-15	Standard Guide for Workforce Education in Nanotechnology Pattern Generation	Published	E56.07: Education and Workforce Development
E3059-16	Standard Guide for Workforce Education in Nanotechnology Infrastructure	Published	E56.07: Education and Workforce Development
E3071-16	Standard Guide for Workforce Education in Materials Synthesis and Processing	Published	E56.07: Education and Workforce Development
E3089-17	Standard Guide for Nanotechnology Workforce Education in Material Properties and Effects of Size	Published	E56.07: Education and Workforce Development
WK63310	New Guide for Visualization and Identification of Nanoparticles in Cells Using Enhanced Darkfield Microscopy with Hyperspectral Imaging Analysis	Under development	E56.08: Nano-Enabled Medical Products
WK60373	New Test Method for Quantitative Measurement of the Chemoattractant Capacity of a Nanoparticulate Material In Vitro	Under development	E56.08: Nano-Enabled Medical Products
WK60553	New Test Method for Evaluation of Nanoparticulate Material Internalization by Phagocytic Cells In Vitro	Under development	E56.08: Nano-Enabled Medical Products
WK60554	New Test Method for Detection of Nitric Oxide Production	Under development	E56.08: Nano-Enabled Medical Products



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Reference	Title	Standard Status	Drafting Body
-	New Test Method for Lipid Quantitation in Liposomal Drug Formulations with HPLC-ELSD (High	Under development	E56.08: Nano-Enabled Medical Products
-	Performance Liquid Chromatography – Evaporative Light Scattering Detection)	Under development	E56.08: Nano-Enabled Medical Products
-	New Test Method for Lipid Quantitation in Liposomal Drug Formulations with HPLC-CAD (High	Under development	E56.08: Nano-Enabled Medical Products
-	Performance Liquid Chromatography – Charged Aerosol Detection)	Under development	E56.08: Nano-Enabled Medical Products
-	New Test Method for Lipid Quantitation in Liposomal Drug Formulations with HPLC-ELSD (High	Under development	E56.08: Nano-Enabled Medical Products
-	Performance Liquid Chromatography – Mass Spectrometry Detection)	Under development	E56.08: Nano-Enabled Medical Products
-	Test Method for Polyethylene Glycol Quantitation on Nanoparticle Samples Using HPLC-ELSD (High Performance Liquid Chromatography – Evaporative Light Scattering Detection)	Under development	E56.08: Nano-Enabled Medical Products

## 2.6. Relevant standardisation documents on Sustainable Manufacturing Framework

### 2.6.1. Sustainability. General

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
-	ISO Guide 82:2014	Guidelines for addressing sustainability in standards	ISO Guide 82:2014 provides guidance to standards writers on how to take account of sustainability in the drafting, revision and updating of ISO standards and similar deliverables. It outlines a methodology that ISO standards writers can use to develop their own approach to addressing sustainability on a subject-specific basis.	Published	-	ISO/TMBG
-	ISO/DGuide 82	Guidelines for addressing sustainability in standards	This document will review ISO Guide 82:2014	Under development	-	ISO/TMBG
CEN/TS 16937:2016	-	Nanotechnologies - Guidance for the responsible development of nanotechnologies	This Technical Specification provides a guidance for the responsible development of nanotechnologies taking into account: - Board Accountability; - Stakeholder Involvement; - Worker Health and Safety; - Benefits to and Risks for Public Health, Safety and the Environment; - Wider Social and Ethical Implications and Impacts; - Engagement with Business Partners; - Transparency and Disclosure. NOTE 1 This Technical Specification contributes to social responsibility as defined in ISO 26000:2010. NOTE 2 Nanotechnology activities include industrial production, R&D, services, and marketing of products. This Technical Specification neither covers labelling and advertising aspects nor is it intended for certification purposes, nor does it	Published	CEN/TC 352	CEN/TC 352/WG 2

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			imply any legally binding agreements. This Technical Specification intends to cover nanotechnology activities involving manufactured nanomaterials, and where relevant incidental nanomaterials.			
CEN/TS 17276:2018	-	Nanotechnologies - Guidelines for Life Cycle Assessment - Application of EN ISO 14044:2006 to Manufactured Nanomaterials	This document provides guidelines for application of Life Cycle Assessments (LCA) of specific relevance to manufactured nanomaterials (MNM), including their use in other products, according to EN ISO 14044:2006. It does not cover incidental nanomaterials.	Published	CEN/TC 352	CEN/TC 352/WG 3
CWA 16768:2014	-	Framework for Sustainable Value Creation in Manufacturing Network	This document covers good-practices for developing business models, governance models, sustainable solutions and performance management for existing and new sustainable production and service networks. It defines a Sustainable Business Modelling process and provides guidance to develop a Sustainability Performance Framework	Published	CEN/WS 072	-
-	ISO 10987:2012	Earth-moving machinery -- Sustainability -- Terminology, sustainability factors and reporting	ISO 10987:2012 sets out general principles for addressing the sustainability of the earth-moving machinery defined in ISO 6165. It establishes a sustainability terminology, identifies significant sustainability factors for earth-moving machines and provides reporting an example of a reporting format for sustainability information. It is applicable to the development and manufacturing processes and the useful life and end-of-life of earth-moving machines.	Published	-	ISO/TC 127

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
-	ISO 10987-2:2017	Earth-moving machinery -- Sustainability -- Part 2: Remanufacturing	ISO 10987-2:2017 gives requirements for identification and labelling, applicable processes, and relevant information for remanufactured components for earth-moving machinery. ISO 10987-2:2017 is applicable to remanufacturing for reuse of components on earth-moving machines as defined in ISO 6165. It can be used for all types of off-road machines.	Published	-	ISO/TC 127
-	ISO 10987-3:2017	Earth-moving machinery -- Sustainability -- Part 3: Used machines	ISO 10987-3:2017 gives requirements and relevant information for evaluating used earth-moving machines. It provides the means to evaluate a used machine, relative to the information provided by the manufacturer in the operator's manual, in order to verify that the used machine is functional as intended by the manufacturer. ISO 10987-3:2017 is applicable to earth-moving machines as defined in ISO 6165 that are used and are planned to be resold.	Published	-	ISO/TC 127
prEN 15643	-	Sustainability of construction works - General framework for assessment of buildings and civil engineering works	This European Standard provides principles and requirements for the assessment of environmental, social and economic performance of buildings and civil engineering works taking into account their technical characteristics and functionality. Assessments of environmental, social and economic performance are the three aspects of sustainability assessment of buildings and civil engineering works, or combination thereof, (hereafter written as "construction works"). The framework applies to all types of construction works, both new and existing, and it	Under development	CEN/TC 350/WG 7	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			<p>is relevant for the assessment of the environmental, social and economic performance of new construction works over their entire life cycle, and of existing construction works over their remaining service life and end of life stage. The sustainability performance assessment of construction works concentrates on the assessment of aspects and impacts of construction works expressed with quantifiable indicators. It includes the assessment of a construction works' influence on the environmental, social and economic impacts and aspects of the local infrastructure beyond the area of curtilage of the building and the civil engineering works, and environmental impacts and aspects resulting from transportation of the users of the civil engineering works and the use and exploitation of the infrastructure itself. It excludes environmental, social and economic risk assessment, but the results of the risk assessment should be taken into consideration. The European Standards developed under this framework do not set the rules for how the different assessment methodologies may provide valuation methods; nor do they prescribe levels, classes or benchmarks for measuring performance. NOTE Valuation methods, levels, classes or benchmarks can be prescribed in the requirements for environmental, social and economic performance in the client's brief, construction regulations, national standards, national codes of practice, construction works</p>			

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			assessment and certification schemes, etc. The rules for assessment of environmental, social and economic aspects of organizations, such as management systems, are not included within this framework. However, the consequences of decisions or actions that influence the environmental, social and economic performance of the object of assessment are taken into account.			
EN 15643-1:2010	-	Sustainability of construction works - Sustainability assessment of buildings - Part 1: General framework	This European Standard provides the general principles and requirements, expressed through a series of standards, for the assessment of buildings in terms of environmental, social and economic performance taking into account technical characteristics and functionality of a building. The assessment will quantify the contribution of the assessed construction works to sustainable construction and sustainable development. The framework applies to all types of buildings and it is relevant for the assessment of the environmental, social and economic performance of new buildings over their entire life cycle, and of existing buildings over their remaining service life and end of life stage. The standards developed under this framework do not set the rules for how the different assessment methodologies may provide valuation methods. Nor do they prescribe levels, classes or benchmarks for measuring performance. NOTE Valuation methods, levels, classes or benchmarks may be prescribed in the requirements for	Published	CEN/TC 350	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			environmental, social and economic performance in the client's brief, building regulations, national standards, national codes of practice, certification schemes, etc. The rules for assessment of environmental, social or economic aspects of organizations are not included within this framework. However, the consequences of decisions or actions that influence the environmental, social and economic performance of the object of assessment are taken into account.			
EN 15643-2:2011	-	Sustainability of construction works - Assessment of buildings - Part 2: Framework for the assessment of environmental performance	This European Standard forms one part of a series of European Standards and provides the specific principles and requirements for the assessment of environmental performance of buildings taking into account technical characteristics and functionality of a building. Assessment of environmental performance is one aspect of sustainability assessment of buildings under the general framework of EN 15643-1. The framework applies to all types of buildings and it is relevant for the assessment of the environmental performance of new buildings over their entire life cycle, and of existing buildings over their remaining service life and end of life stage. In this series of standards, the environmental dimension of sustainability is limited to the assessment of environmental aspects and impacts of a building on the local, regional and global environment. The assessment is on Life Cycle Assessment and additional quantifiable environmental information	Published	CEN/TC 350	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			expressed with quantified indicators. It excludes the assessment of a building's influence on the environmental aspects and impacts of the local infrastructure beyond the area of the building site, and environmental aspects and impacts resulting from transportation of the users of the building. It also excludes environmental risk assessment. The standards developed under this framework do not set the rules for how different building assessment schemes may provide valuation methods. Nor do they prescribe levels, classes or benchmarks for measuring performance. NOTE Valuation methods, levels, classes or benchmarks may be prescribed in the requirements for environmental, social and economic performance in the client's brief, building regulations, national standards, national codes of practice, building assessment and certification schemes, etc. (...)			
EN 15643-3:2012	-	Sustainability of construction works - Assessment of buildings - Part 3: Framework for the assessment of social performance	This European Standard forms one part of a suite of European Standards and provides the specific principles and requirements for the assessment of social performance of buildings taking into account technical characteristics and functionality of a building. Assessment of social performance is one aspect of sustainability assessment of buildings under the general framework of EN 15643-1. The framework applies to all types of buildings, both new and existing, and it is relevant for the assessment of the social performance of new buildings over all stages of their life cycle, and of existing buildings to their end of life. NOTE 1	Published	CEN/TC 350/WG 5	-



## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			<p>Although all stages of the life cycle are considered in this European Standard, the choice of what is practical to cover in the implementation of this framework is the subject of prEN 16309, which is under development. The first version of prEN 16309 may limit the application of the framework to fewer than all life-cycle stages, depending on what methods are appropriate for European standardisation at this time. Future revisions of prEN 16309 will include the assessment of social performance for other stages of the building life cycle as appropriate methods for measurement are developed and become suitable for European standardisation. The social dimension of sustainability concentrates on the assessment of aspects and impacts of a building expressed with quantifiable indicators. The social performance measures will be represented through indicators for the following social performance categories: ¼ accessibility; ¼ adaptability; ¼ health and comfort; ¼ loadings on the neighbourhood; ¼ maintenance; ¼ safety / security; ¼ sourcing of materials and services; ¼ stakeholder involvement. The European Standards developed under this framework do not set the rules for how building assessment schemes may provide valuation methods. Nor do they prescribe levels, classes or benchmarks for measuring performance. NOTE 2 Valuation methods, levels, classes or benchmarks may be prescribed in the requirements for environmental, social and economic performance</p>			

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			in the client's brief, building regulations, national standards, national codes of practice, building assessment and certification schemes, etc. The rules for assessment of social aspects of organisations are not included within this framework. However, the consequences of decisions or actions that influence the social performance of the object of assessment are taken into account.			
EN 15643-4:2012	-	Sustainability of construction works - Assessment of buildings - Part 4: Framework for the assessment of economic performance	This European Standard forms one part of a series of European Standards for the assessment of buildings and provides specific principles and requirements for the assessment of economic performance of buildings taking into account technical characteristics and functionality of a building. Assessment of economic performance is one aspect of sustainability assessment of buildings under the general framework of EN 15643-1. The framework applies to all types of buildings and it is relevant for the assessment of the economic performance of new buildings over their life cycle, and of existing buildings over their remaining service life and end of life stage. The economic performance assessment of a building addresses the life cycle costs and other economic aspects, all expressed through quantitative indicators. It excludes the economic risk assessment of a building and return on investment calculations It includes economic aspects of a building relating to the built environment within the area of the building site, it does not include	Published	CEN/TC 350/WG 4	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			economic aspects beyond the area of the building site, e.g. such as economic impacts of construction of local infrastructure or economic impacts resulting from transportation of the users of the building or economic impacts of a construction project on local community. The standards developed under this framework do not set the rules for how the different assessment methodologies may provide valuation methods nor do they prescribe levels, classes or benchmarks for measuring performance. NOTE Valuation methods, levels, classes or benchmarks may be prescribed in the requirements for economic performance in the client's brief, building regulations, national standards, national codes of practice, building assessment and certification schemes, etc. The rules for assessment of economic aspects of organizations, such as management systems, are not included within this framework. However, the consequences of decisions or actions that influence the economic performance of the object of assessment are taken into account.			
EN 15643-5:2017	-	Sustainability of construction works - Sustainability assessment of buildings and civil engineering works - Part 5: Framework on specific principles and	This European Standard provides specific principles and requirements for the assessment of environmental, social and economic performance of civil engineering works taking into account its technical characteristics and functionality. Assessments of environmental, social and economic performance are the three aspects of sustainability assessment of civil engineering	Published	CEN/TC 350/WG 6	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
		requirement for civil engineering works	works. The framework applies to all types of civil engineering works, both new and existing, and it is relevant for the assessment of the environmental, social and economic performance of new civil engineering works over their entire life cycle, and of existing civil engineering works over their remaining service life and end of life stage. The sustainability performance assessment of civil engineering works concentrates on the assessment of aspects and impacts of civil engineering works expressed with quantifiable indicators. It includes the assessment of a civil engineering works' influence on the environmental, social and economic impacts and aspects of the local infrastructure beyond the area of the civil engineering works, and environmental impacts and aspects resulting from transportation of the users of the civil engineering works and the use and exploitation of the infrastructure itself. It excludes environmental, social and economic risk assessment, but the results of the risk assessment should be taken into consideration. The European Standards developed under this framework do not set the rules for how the different assessment methodologies may provide valuation methods; nor do they prescribe levels, classes or benchmarks for measuring performance. NOTE Valuation methods, levels, classes or benchmarks can be prescribed in the requirements for environmental, social and economic performance in the client's brief, construction regulations,			

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			national standards, national codes of practice, civil engineering works assessment and certification schemes, etc. The rules for assessment of environmental, social and economic aspects of organizations, such as management systems, are not included within this framework. However, the consequences of decisions or actions that influence the environmental, social and economic performance of the object of assessment are taken into account.			
CEN/TR 17005:2016	-	Sustainability of construction works - Additional environmental impact categories and indicators - Background information and possibilities - Evaluation of the possibility of adding environmental impact categories and related indicators and calculation methods for the assessment of the environmental performance of buildings	This Technical Report (TR) has been developed by CEN/TC 350/WG 1 and WG 3 to provide a clear and structured view on the relevance, robustness and applicability of a predefined set of additional impact categories and related indicators for the assessment of the environmental performance of construction works, construction products and building materials. The TR describes the evaluation criteria that are used to determine, for these impact categories, the suitability of indicators and calculation method(s) for inclusion in the standards EN 15978 and EN 15804 (or other CEN/TC 350 standards as appropriate) in terms of their: a) relevance to: 1) the environment, 2) construction works, 3) construction products, and 4) EU policy; b) scientific robustness and certainty; and c) applicability of the impact assessment method(s). The additional impact categories examined in the TR are: - human toxicity and ecotoxicity; - particulate matter; - land use; - biodiversity; - water scarcity; and - ionizing	Published	CEN/TC 350/WG 1	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			<p>radiation. Because EN 15978 and EN 15804 are founded on a life cycle approach, the impact categories, indicators and methods reviewed are predominantly based on their potential suitability for application in LCA. In relation to some of the areas of concern, however, where LCA methods might not be sufficiently robust or developed, some non-LCA based indicators and methods are also considered. Due to the scope of LCA used in the EN 15804 and EN 15978, impacts to users of buildings due to direct exposure to harmful emissions fall outside the scope of this TR. This falls under the scope of CEN/TC 351. Important information related to this aspect found during the development of this TR, is however mentioned in the TR. Uncertainty is an important issue in LCA. General assessment of the uncertainty related to impact assessment models is considered in the evaluation framework of this TR. However, the TR does not lay down a maximum uncertainty level to be considered acceptable in the context of the CEN standards EN 15804 and EN 15978, nor does it provide exact figures on uncertainties. Annex A of the TR provides a description of options that may be considered for incorporating selected impact categories/indicator in the standards EN 15978 and EN 15804. The TR recognizes and takes account of: - the work done by the European Commission, Joint Research Centre (EC-JRC), in the development of the International Reference Life Cycle Data System (ILCD) Handbook</p>			

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			Recommendations, - other reports and scientific studies into the methods and application of the indicators reviewed, - findings of specific activities connected with this work such as of the CEN/TC 350 Workshop, held in Brussels on 24-25 June 2014.			
CEN/TR 17005:2016/AC	-	Sustainability of construction works - Additional environmental impact categories and indicators - Background information and possibilities - Evaluation of the possibility of adding environmental impact categories and related indicators and calculation methods for the assessment of the environmental performance of buildings		Under development	CEN/TC 350/WG 1	-
EN 15978:2011	-	Sustainability of construction works - Assessment of environmental performance of buildings - Calculation method	This European Standard specifies the calculation method, based on Life Cycle Assessment (LCA) and other quantified environmental information, to assess the environmental performance of a building, and gives the means for the reporting and communication of the outcome of the assessment. The standard is applicable to new and existing buildings and refurbishment projects. The standard gives: - the description of the object of	Published	CEN/TC 350/WG 1	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			assessment; - the system boundary that applies at the building level; - the procedure to be used for the inventory analysis; - the list of indicators and procedures for the calculations of these indicators; - the requirements for presentation of the results in reporting and communication; - and the requirements for the data necessary for the calculation. The approach to the assessment covers all stages of the building life cycle and is based on data obtained from Environmental Product Declarations (EPD), their "information modules" (prEN 15804) and other information necessary and relevant for carrying out the assessment. The assessment includes all building related construction products, processes and services, used over the life cycle of the building. The interpretation and value judgments of the results of the assessment are not within the scope of this European Standard.			
prEN 15978 rev	-	Sustainability of construction works - Assessment of environmental performance of buildings - Calculation method	This European Standard specifies the calculation method, based on Life Cycle Assessment (LCA) and other quantified environmental information, to assess the environmental performance of a building, and gives the means for the reporting and communication of the outcome of the assessment. The standard is applicable to new and existing buildings and refurbishment projects. The standard gives: - the description of the object of assessment; - the system boundary that applies at the building level; - the procedure to be used for the inventory analysis; - the list of indicators and	Under development	CEN/TC 350/WG 1	-



## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			procedures for the calculations of these indicators; - the requirements for presentation of the results in reporting and communication; - and the requirements for the data necessary for the calculation. The approach to the assessment covers all stages of the building life cycle and is based on data obtained from Environmental Product Declarations (EPD), their "information modules" (prEN 15804) and other information necessary and relevant for carrying out the assessment. The assessment includes all building related construction products, processes and services, used over the life cycle of the building. The interpretation and value judgments of the results of the assessment are not within the scope of this European Standard.			
EN 16309:2014+A1:2014	-	Sustainability of construction works - Assessment of social performance of buildings - Calculation methodology	This European Standard is one part of a suite of European Standards. The standard provides the specific methods and requirements for the assessment of social performance of a building while taking into account the building's functionality and technical characteristics. This European Standard applies to all types of buildings, both new and existing. In this first version of the standard, the social dimension of sustainability concentrates on the assessment of aspects and impacts for the use stage of a building expressed using the following social performance categories (from EN 15643 3): - accessibility; - adaptability; - health and comfort; - impacts on the neighbourhood; - maintenance; - safety and	Published	CEN/TC 350/WG 5	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			<p>security. NOTE 1 Only impacts and aspects of the above social performance categories are deemed to have an agreed basis for European standardization at this time. Two of the social performance categories included in EN 15643–3 (sourcing of materials and services and stakeholder involvement) are not deemed to be ready for standardization at this time and will be considered for inclusion in future versions of this standard (see informative Annex C). This standard does not set the rules for how building assessment schemes may provide valuation methods. Nor does it prescribe levels, classes or benchmarks of performance. Valuation methods, levels, classes or benchmarks may be prescribed in the requirements for environmental, social and economic performance in the client's brief, building regulations, national standards, national codes of practice, building assessment and certification schemes, etc. NOTE 2 Where National building regulations give minimum requirements and reference to assessment methods on these aspects, the social performance determined by assessment according to this standard can be used to determine the degree to which the building goes beyond the regulatory/legal requirements. The corporate social responsibility (CSR) of organizations is not covered by this standard. The standard gives requirements for: - the description of the object of assessment; - the system boundary that applies at the building level; - the</p>			

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			list of indicators and procedures for the application of these indicators; - the presentation of the results in reporting and communication; - the data necessary for the application of the standard, and - verification.			
EN 16627:2015	-	Sustainability of construction works - Assessment of economic performance of buildings - Calculation methods	This European Standard specifies the calculation methods, based on Life Cycle Costing (LCC) and other quantified economic information, to assess the economic performance of a building, and gives the means for the reporting and communication of the outcome of the assessment. This European Standard is applicable to new and existing buildings and refurbishment projects. This European Standard gives: - the description of the object of assessment; - the system boundary that applies at the building level; - the scope and procedure to be used for the analysis; - the list of indicators and procedures for the calculations of these indicators; - the requirements for presentation of the results in reporting and communication; - and the requirements for the data necessary for the calculation. The approach to the assessment covers all stages of the building life cycle and includes all building related construction products, processes and services, used over the life cycle of the building. The interpretation and value judgments of the results of the assessment are not within the scope of this European Standard.	Published	CEN/TC 350/WG 4	-

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
350028	-	Sustainability of construction works - Sustainability assessment civil engineering works - Calculation methods	-	Under development	CEN/TC 350/WG 6	-
-	ISO 15392:2008	Sustainability in building construction -- General principles	ISO 15392:2008 identifies and establishes general principles for sustainability in building construction. It is based on the concept of sustainable development as it applies to the life cycle of buildings and other construction works, from their inception to the end of life. ISO 15392:2008 is applicable to buildings and other construction works individually and collectively, as well as to the materials, products, services and processes related to the life cycle of buildings and other construction works. ISO 15392:2008 does not provide levels (benchmarks) that can serve as the basis for sustainability claims. It is not intended to provide the basis for assessment of organizations or other stakeholders.	Published	-	ISO/TC 59/SC 17
-	ISO/TS 12720:2014	Sustainability in buildings and civil engineering works -- Guidelines on the application of the general principles in ISO 15392	ISO/TS 12720:2014 provides guidance for the application of the general principles of sustainability in buildings and civil engineering works elaborated in ISO 15392. It shows the different actors involved with the construction works how to take these principles into account in their decision-making processes in order to increase the contribution of the construction works to sustainability and sustainable development. ISO/TS 12720:2014 provides a step-	Published	-	ISO/TC 59/SC 17

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			by-step approach for: encouraging the application of the general principles by all stakeholders at each stage of the project and its use, from the decision to build and the initial development of the project brief until the end-of-life of the construction works; helping interested parties to consider and/or incorporate sustainability thinking in all phases of the building's or civil engineering works' life cycle, for all relevant issues of concern, by raising key questions in relation to the general principles; understanding the outcome (effect) of the application of the general principles; and building on acquired experience to develop best practices and engendering a continuous improvement process.			
-	ISO/DIS 21678	Sustainability in buildings and civil engineering works -- Indicators and benchmarks -- Principles for the development and use of benchmarks	-	Under development	-	ISO/TC 59/SC 17/WG 2
-	ISO 21929-1:2011	Sustainability in building construction -- Sustainability indicators -- Part 1: Framework for the development of indicators and a core set of indicators for buildings	ISO 21929-1:2011 establishes a core set of indicators to take into account in the use and development of sustainability indicators for assessing the sustainability performance of new or existing buildings, related to their design, construction, operation, maintenance, refurbishment and end of life. Together, the core set of indicators provides measures to express the contribution of a building(s) to sustainability and	Published	-	ISO/TC 59/SC 17

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			<p>sustainable development. These indicators represent aspects of buildings that impact on areas of protection related to sustainability and sustainable development. The object of consideration in ISO 21929-1:2011 is a building or a group of buildings and the external works within the site (curtilage). ISO 21929-1:2011 follows the principles set out in ISO 15392 and, where appropriate, is intended for use in conjunction with, and following the principles set out in, ISO 26000, ISO 14040 and the family of International Standards that includes ISO 14020, ISO 14021, ISO 14024 and ISO 14025. Where deviation occurs or where more specific requirements are stated, ISO 21929-1:2011 takes precedence. ISO 21929-1:2011 adapts general sustainability principles for buildings; includes a framework for developing sustainability indicators for use in the assessment of economic, environmental and social impacts of buildings; determines the aspects for consideration when defining a core set of sustainability indicators for buildings; establishes a core set of indicators; describes how to use sustainability indicators; and gives rules for establishing a system of indicators. ISO 21929-1:2011 does not give guidelines for the weighting of indicators or the aggregation of assessment results.</p>			

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
-	ISO/TS 21929-2:2015	Sustainability in building construction -- Sustainability indicators -- Part 2: Framework for the development of indicators for civil engineering works	ISO/TS 21929-2:2015 establishes a list of aspects and impacts which should be taken as the basis for the development of sustainability indicators for assessing the sustainability performance of new or existing civil engineering works, related to their design, construction, operation, maintenance, refurbishment and end-of-life. Together, the indicators developed from this list of aspects and impacts provide measures to express the contribution of a civil engineering works to sustainability and sustainable development. The developed indicators should represent aspects of civil engineering works that impact on issues of concern related to sustainability and sustainable development. The object of consideration in ISO/TS 21929-2:2015 is a civil engineering works, a part of the civil engineering works or a combination of several civil engineering works.	Published	-	ISO/TC 59/SC 17/WG 5
-	ISO 21931-1:2010	Sustainability in building construction -- Framework for methods of assessment of the environmental performance of construction works -- Part 1: Buildings	ISO 21931-1:2010 provides a general framework for improving the quality and comparability of methods for assessing the environmental performance of buildings and their related external works. It identifies and describes issues to be taken into account in the use and development of methods of assessment of the environmental performance for new or existing buildings in their design, construction, operation, maintenance and refurbishment, and in the deconstruction stages. The object of assessment in ISO 21931-1:2010 is	Published	-	ISO/TC 59/SC 17/WG 4

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			the building and the external works within its site (curtilage).			
-	ISO/WD 21931-1	Sustainability in buildings and civil engineering works -- Framework for methods of assessment of the environmental, social and economic performance of construction works as a basis for sustainability assessment -- Part 1: Buildings	-	Under development	-	ISO/TC 59/SC 17/WG 4
-	ISO 21931-2:2019	Sustainability in buildings and civil engineering works -- Framework for methods of assessment of the environmental, social and economic performance of construction works as a basis for sustainability assessment -- Part 2: Civil engineering works	This document provides a general framework for improving the quality and comparability of methods for assessing the contribution of civil engineering works and their related external works to sustainable development based on a life cycle approach. This document aims to bridge the gap between regional and national methods for the assessment of the sustainability performance of civil engineering works by providing a common framework for their expression. This document identifies and describes issues to be taken into account in the development and use of methods for the assessment of the sustainability performance for all types of civil engineering works, both new and existing, and it is relevant for the assessment of the environmental, social and	Published	-	ISO/TC 59/SC 17/WG 5



## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			<p>economic performance of both new and existing civil engineering works over their entire life cycle. The object of assessment in this document is the civil engineering works itself and its area of influence. Assessments can be undertaken either for the whole civil engineering works, for a part of the civil engineering works, or for a combination of several civil engineering works. This document excludes environmental, social and economic risk assessment, but the results of a risk assessment can be taken into consideration. This document is intended to be used in conjunction with, and following the principles set out in, ISO 15392 and the ISO 14000 family of International Standards. The evaluation of technical and functional performance of the civil engineering works is outside the scope of this document, but the technical and functional characteristics are considered within this framework by reference to the functional equivalent. The functional equivalent takes into account the technical and functional requirements and forms the basis for comparisons of the results of the assessment. Assessment methods that consider only one or two of the three dimensions of sustainability are outside the scope of this document. This document does not set benchmarks or levels of performance relative to environmental, social and economic aspects and impacts. The rules for methods of assessment to consider in the assessment of environmental, social and</p>			

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			economic aspects of operation practices are included within this framework, and the consequences of decisions or actions that influence the environmental, social and economic performance of the object of assessment are identified so that they can be taken into account.			
-	E2986-18	Standard Guide for Evaluation of Environmental Aspects of Sustainability of Manufacturing Processes	This guide provides guidance to develop manufacturer-specific procedures for evaluating the environmental sustainability performance of manufacturing processes. This guide introduces decision support methods that can be used to improve sustainability performance. The scope of this guide is constrained by the manufacturing phase of the life cycle. The guide addresses specifics related to the processes and procedures within this phase. This guide will allow manufacturers to make effective evaluations during plant and enterprise-wide decision-making within the manufacturing phase. This guide focuses on environmental sustainability impacts, though social and economic impacts are not explicitly excluded. This guide addresses: Setting boundaries for the evaluation of environmental sustainability of a process or processes, Identifying the process and equipment-related parameters necessary for environmental sustainability-driven process evaluation, Creating process models using these parameters, Utilizing process models to support consistent evaluations and sustainability-driven decision-making in a manufacturing enterprise. This guide may be used	Published	-	(ASTM E60.13)

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			to complement other standards that address sustainability and the product life cycle. This guide most closely relates to the inventory component as discussed in the ISO 14040 series (ISO 14040, ISO 14044) standards, efficiency as discussed in the ISO 50000 series (ISO 50001) standards, and resource management as discussed in the ISO 55000 series (ISO 55001) standards. This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.			
-	E2987 / E2987M - 16	Standard Terminology for Sustainable Manufacturing	The standard includes terminology applicable to sustainable manufacturing. The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard	_Published, superseded by E2987E2987M	-	(ASTM E60.13)
-	E3012-16	Standard Guide for Characterizing Environmental Aspects of Manufacturing Processes	This guide provides manufacturers an approach to characterize any category of manufacturing process and to systematically capture and describe relevant environmental information. This guide defines a Process Characterization Methodology that uses graphical and formal representations to support the construction of	Published	-	(ASTM E60.13)

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			<p>unit manufacturing process (UMP) information models for characterizing the environmental aspects of manufacturing processes. This guide defines the graphical UMP information model as being comprised of four elements (input, output, product and process information, and resources) that supports manufacturers in systematically identifying, collecting, structuring, and visualizing manufacturing information. This guide defines the formal representation of the UMP information model through the use of a modelling method and language that can effectively convey the meaning and intent of processes they characterize. This guide provides the necessary structure and formality for identifying and capturing key information needs to assess manufacturing performance, yet provides no details about an actual assessment of the process performance. This guide provides an approach to link individual UMP information models together to create a network or system of UMP models that extends the characterization of environmental aspects beyond an individual process to a production system or the product itself. This guide may be used to complement other standards that address sustainability and the product life cycle. This guide most closely relates to the inventory component as discussed in the ISO 14040 series (ISO 14044) standards, and resource management as discussed in the ISO 55000 series (ISO 55001) standards. This guide does not purport to address</p>			

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			all of the security issues and the risks associated with manufacturing information. It is the responsibility of the user of this standard to follow practices and establish appropriate information technology related security measures. This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.			
-	E3096-18	Standard Guide for Definition, Selection, and Organization of Key Performance Indicators for Environmental Aspects of Manufacturing Processes	This guide addresses Key Performance Indicators (KPIs) for environmental aspects of manufacturing processes. This guide provides a procedure for identifying candidate KPIs from existing sources for environmental aspects of manufacturing processes. This guide provides a procedure for defining new candidate KPIs that are not available from existing sources for environmental aspects of manufacturing processes. This guide defines a methodology for selecting effective KPIs from a list of candidate KPIs based on KPI criteria selected from Appendix X3 or defined by users. This guide provides a procedure for normalizing KPIs, assigning weights to those KPIs, and aligning them to environmental objectives. KPIs of Manufacturing Operation Management activities as defined in IEC 62264-1 are out of the scope since they are specifically addressed in ISO 22400-2. How to evaluate environmental impacts is out of the scope since it is addressed in Guide E2986.	Published	-	(ASTM E60.13)

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			This guide can be used to complement other standards that address environmental aspects of manufacturing processes, for example, Guide E2986, Terminology E2987/E2987M, and Guide E3012. This guide does not purport to address the security risks associated with manufacturing and environmental information. It is the responsibility of the user of this standard to follow practices and establish appropriate information technology related security measures. This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.			
-	OECD Sustainable Manufacturing Toolkit	OECD Sustainable Manufacturing Toolkit. Seven steps to environmental excellence. Start-up guide	This start-up guide provides easy-to-read guidance to help the reader understand the basic issues and start measurement step by step. It aims to provide a practical starting point for businesses around the world to improve the efficiency of their production processes and products enabling them to contribute to sustainable development and green growth. It includes an internationally applicable common set of indicators helping businesses measure their environmental performance at the level of a plant or facility. This edition focuses on the environmental aspects of sustainable development.	Published	-	(OECD)

## 2.6.2. Sustainability. Social

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
-	ISO 26000:2010	Guidance on social responsibility	ISO 26000:2010 provides guidance to all types of organizations, regardless of their size or location, on: concepts, terms and definitions related to social responsibility; the background, trends and characteristics of social responsibility; principles and practices relating to social responsibility; the core subjects and issues of social responsibility; integrating, implementing and promoting socially responsible behaviour throughout the organization and, through its policies and practices, within its sphere of influence; identifying and engaging with stakeholders; and communicating commitments, performance and other information related to social responsibility. ISO 26000:2010 is intended to assist organizations in contributing to sustainable development. It is intended to encourage them to go beyond legal compliance, recognizing that compliance with law is a fundamental duty of any organization and an essential part of their social responsibility. It is intended to promote common understanding in the field of social responsibility, and to complement other instruments and initiatives for social responsibility, not to replace them. In applying ISO 26000:2010, it is advisable that an organization take into consideration societal, environmental, legal, cultural, political and	Published	-	ISO/TMBG

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			<p>organizational diversity, as well as differences in economic conditions, while being consistent with international norms of behaviour. ISO 26000:2010 is not a management system standard. It is not intended or appropriate for certification purposes or regulatory or contractual use. Any offer to certify, or claims to be certified, to ISO 26000 would be a misrepresentation of the intent and purpose and a misuse of ISO 26000:2010. As ISO 26000:2010 does not contain requirements, any such certification would not be a demonstration of conformity with ISO 26000:2010. ISO 26000:2010 is intended to provide organizations with guidance concerning social responsibility and can be used as part of public policy activities. However, for the purposes of the Marrakech Agreement establishing the World Trade Organization (WTO), it is not intended to be interpreted as an “international standard”, “guideline” or “recommendation”, nor is it intended to provide a basis for any presumption or finding that a measure is consistent with WTO obligations. Further, it is not intended to provide a basis for legal actions, complaints, defences or other claims in any international, domestic or other proceeding, nor is it intended to be cited as evidence of the evolution of customary international law.</p>			



## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
-	ISO 45001:2018	Occupational health and safety management systems -- Requirements with guidance for use	ISO 45001:2018 specifies requirements for an occupational health and safety (OH&S) management system, and gives guidance for its use, to enable organizations to provide safe and healthy workplaces by preventing work-related injury and ill health, as well as by proactively improving its OH&S performance. ISO 45001:2018 is applicable to any organization that wishes to establish, implement and maintain an OH&S management system to improve occupational health and safety, eliminate hazards and minimize OH&S risks (including system deficiencies), take advantage of OH&S opportunities, and address OH&S management system nonconformities associated with its activities. ISO 45001:2018 helps an organization to achieve the intended outcomes of its OH&S management system. Consistent with the organization's OH&S policy, the intended outcomes of an OH&S management system include: a) continual improvement of OH&S performance; b) fulfilment of legal requirements and other requirements; c) achievement of OH&S objectives. ISO 45001:2018 is applicable to any organization regardless of its size, type and activities. It is applicable to the OH&S risks under the organization's control, taking into account factors such as the context in which the organization operates and the needs and expectations of its workers and other interested parties. ISO 45001:2018 does not state specific criteria for OH&S performance, nor is it	Published	-	ISO/TC 283

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			prescriptive about the design of an OH&S management system. ISO 45001:2018 enables an organization, through its OH&S management system, to integrate other aspects of health and safety, such as worker wellness/wellbeing. ISO 45001:2018 does not address issues such as product safety, property damage or environmental impacts, beyond the risks to workers and other relevant interested parties. ISO 45001:2018 can be used in whole or in part to systematically improve occupational health and safety management. However, claims of conformity to this document are not acceptable unless all its requirements are incorporated into an organization's OH&S management system and fulfilled without exclusion.			
-	ISO 31000:2018	Risk management -- Guidelines	ISO 31000:2018 provides guidelines on managing risk faced by organizations. The application of these guidelines can be customized to any organization and its context. ISO 31000:2018 provides a common approach to managing any type of risk and is not industry or sector specific. ISO 31000:2018 can be used throughout the life of the organization and can be applied to any activity, including decision-making at all levels.	Published	-	ISO/TC 262
-	ISO 20400:2017	Sustainable procurement - - Guidance	ISO 20400:2017 provides guidance to organizations, independent of their activity or size, on integrating sustainability within procurement, as described in ISO 26000. It is	Published	-	ISO/TMBG

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			intended for stakeholders involved in, or impacted by, procurement decisions and processes.			
EN ISO 12100:2010	ISO 12100:2010	Safety of machinery -- General principles for design -- Risk assessment and risk reduction	ISO 12100:2010 specifies basic terminology, principles and a methodology for achieving safety in the design of machinery. It specifies principles of risk assessment and risk reduction to help designers in achieving this objective. These principles are based on knowledge and experience of the design, use, incidents, accidents and risks associated with machinery. Procedures are described for identifying hazards and estimating and evaluating risks during relevant phases of the machine life cycle, and for the elimination of hazards or sufficient risk reduction. Guidance is given on the documentation and verification of the risk assessment and risk reduction process. ISO 12100:2010 is also intended to be used as a basis for the preparation of type-B or type-C safety standards. It does not deal with risk and/or damage to domestic animals, property or the environment.	Published	CEN/TC 114	ISO/TC 199

## 2.6.3. Sustainability. Environmental

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
EN ISO 14001:2015	ISO 14001:2015	Environmental management systems -- Requirements with guidance for use	ISO 14001:2015 specifies the requirements for an environmental management system that an organization can use to enhance its environmental performance. ISO 14001:2015 is intended for use by an organization seeking to manage its environmental responsibilities in a systematic manner that contributes to the environmental pillar of sustainability. ISO 14001:2015 helps an organization achieve the intended outcomes of its environmental management system, which provide value for the environment, the organization itself and interested parties. Consistent with the organization's environmental policy, the intended outcomes of an environmental management system include: · enhancement of environmental performance; · fulfilment of compliance obligations; · achievement of environmental objectives. ISO 14001:2015 is applicable to any organization, regardless of size, type and nature, and applies to the environmental aspects of its activities, products and services that the organization determines it can either control or influence considering a life cycle perspective. ISO 14001:2015 does not state specific environmental performance criteria. ISO 14001:2015 can be used in whole or in part to systematically improve	Published	CEN/SS S26	ISO/TC 207/SC 1

## OASIS

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			environmental management. Claims of conformity to ISO 14001:2015, however, are not acceptable unless all its requirements are incorporated into an organization's environmental management system and fulfilled without exclusion.			
EN ISO 14031:2013	ISO 14031:2013	Environmental management -- Environmental performance evaluation -- Guidelines	ISO 14031:2013 gives guidance on the design and use of environmental performance evaluation (EPE) within an organization. It is applicable to all organizations, regardless of type, size, location and complexity. ISO 14031:2013 does not establish environmental performance levels. The guidance in ISO 14031:2013 can be used to support an organization's own approach to EPE, including its commitments to compliance with legal and other requirements, the prevention of pollution, and continual improvement.	Published	CEN/SS S26	ISO/TC 207/SC 4
EN ISO 14040:2006	ISO 14040:2006	Environmental management -- Life cycle assessment -- Principles and framework	ISO 14040:2006 describes the principles and framework for life cycle assessment (LCA) including: definition of the goal and scope of the LCA, the life cycle inventory analysis (LCI) phase, the life cycle impact assessment (LCIA) phase, the life cycle interpretation phase, reporting and critical review of the LCA, limitations of the LCA, the relationship between the LCA phases, and conditions for use of value choices and optional elements. ISO 14040:2006 covers life cycle assessment (LCA) studies and life cycle inventory (LCI) studies. It does not describe the LCA technique in detail, nor does it specify methodologies for the individual phases of the	Published	CEN/SS S26	ISO/TC 207/SC 5

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Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
			LCA. The intended application of LCA or LCI results is considered during definition of the goal and scope, but the application itself is outside the scope of this International Standard.			

## 2.6.4. Sustainability. Economic

Reference (Europe)	Reference (International)	Title	Scope	Standard Status	Drafting Body (Europe)	Drafting Body (International)
EN ISO 9001:2015	ISO 9001:2015	Quality management systems -- Requirements	ISO 9001:2015 specifies requirements for a quality management system when an organization: a) needs to demonstrate its ability to consistently provide products and services that meet customer and applicable statutory and regulatory requirements, and b) aims to enhance customer satisfaction through the effective application of the system, including processes for improvement of the system and the assurance of conformity to customer and applicable statutory and regulatory requirements. All the requirements of ISO 9001:2015 are generic and are intended to be applicable to any organization, regardless of its type or size, or the products and services it provides.	Published	CEN/SS F20	ISO/TC 176/SC 2
(Especificación UNE 0060:2018)	-	Industry 4.0. Management system for digitization. Requirements	-	_Published (Spanish)	(CTN GET 24 of UNE)	
(Especificación UNE 0061:2019)	-	Industry 4.0. Management system for digitization. Requirements assessment.	-	_Published (Spanish)	(CTN GET 24 of UNE)	

### 3. Conclusions

UNE will draft by M14, supported by the investigation performed in this document on the relevant standardisation landscape, D7.12, Guides for the use of standardisation by Test Bed users. This document will feed the standardisation services of the OASIS Open Innovation Test Beds (OITB). The guide will ease the Test Bed Users to identify the relevant standardisation environment and the relevant knowledge and contacts to start the process to standardise their innovative products.

Considering the contribution of OASIS to the ongoing and future standardisation developments, after the analysis of the current standardization context, it has been found that the activity of many standardization technical bodies can contribute to the works of the OASIS project. CEN/TC 352 and CLC/SR 113 at European level and ISO/TC 229 and IEC/TC 113 at International level are the ones most highly related to nanotechnology. This document identifies 14 additional technical bodies producing standards relevant to nanotechnology, plus 16 relevant to sustainability according to the parameters stated in the document. However, considering a Sustainable Manufacturing Framework for the Pilot Lines and the different products that could be produced under each Test Bed, none of these standardisation technical bodies fully covers the scope of OASIS.

According to the findings of this document, UNE will produce an internal proposal of action plan for the contribution to the ongoing and future standardisation developments,

- identifying the most relevant technical bodies,
- planning the interaction activities with those technical bodies (early contact), and
- analysing the most suitable contribution to standardisation (type of standardisation deliverable and subject)

The drafting of the proposal of action plan will start on M9.



#### 4. Dissemination Level

The dissemination level of this deliverable of the OASIS project is public.