TECHNICAL SPECIFICATION

ISO/TS 12025

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Nanomaterials — Quantification of nano-object release from powders by generation of aerosols

Nanomatériaux — Quantification de la libération de nano-objets par les poudres par production d'aérosols

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 229, *Nanotechnologies*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 352, *Nanotechnologies*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO/TS 12025:2012), which has been technically revised.

The main changes compared to the previous edition are as follows:

— revised and updated the Introduction and the Bibliography;

— updated 6.4.1 and 6.4.2 and Annex A with regards to the description and selection of the sample treatment procedure in accordance with new European standards.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Industrial powders when subjected to external energy or stress from handling and air flow will release particles entrained in the surrounding air to form aerosols. Aerosols in the nanoscale are more dynamic than micrometre sized particles because of greater sensitivity to physical effects such as Brownian diffusion. Porosity and cohesion of the powder can be much higher than for materials containing larger particles with more resistance to flow and lower volume-specific surface area. Nano-objects in powdered nanostructured materials can dominate relevant properties of the bulk material by particle-particle interactions that form clusters such as agglomerates.

Aerosol release characterization consists of three main stages: generation, transport and measurement. In general, to reduce transport losses and aerosol agglomeration, the distance between generation and measurement should be minimized. Although there are potentially many different approaches[35], the generation of an aerosol is usually physically modelled on different representative scenarios (e.g. to simulate typical manual or machine powder handling processes or worst-case highly energetic dispersion).

This document is only applicable for measuring the release of nano-objects from powders. This allows comparisons of the nano-object release from different powders using the same generation and measurement system. The choice of the measurement method must take into account the characteristics (e.g. time-related dependence) of the generation system and the potential for losses and agglomeration during the transport and entry into the measuring instrumentation. Therefore, this document provides a summary of the generation and measurement methods currently available to assist material scientists and engineers in comparing the nano-object release from different powders.

The quantification of the release of nano-objects from powders described in this document cannot be used as a substitute for dustiness testing or for a health-related risk assessment.

Nanomaterials — Quantification of nano-object release from powders by generation of aerosols

WARNING — The execution of the provisions of this document should be entrusted only to appropriately qualified and experienced people, for whose use it has been produced.

1 Scope

This document describes methods 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. Particle number concentration and size distribution of the aerosol are measured and the mass concentration is derived. This document provides information on factors to be considered when selecting among 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 adressed in this document.

This document does not include the characterization of particle sizes within the powder. Tribological methods are excluded where direct mechanical friction is applied to grind or abrade the material.

2 Normative references

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

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

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

3 Terms and definitions

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

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

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

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

3.1 General terms

3.1.1
release from powder
transfer of material from a powder to a liquid or gas as a consequence of a disturbance

3.1.2
nano-object number release
n
total number of *nano-objects* (3.2.9), released from a sample as a consequence of a disturbance