PD ISO/TS 20660:2019

BSI Standards Publication

Nanotechnologies — Antibacterial silver nanoparticles — Specification of characteristics and measurement methods

National foreword

This Published Document is the UK implementation of ISO/TS 20660:2019.

The UK participation in its preparation was entrusted to Technical Committee NTI/1, Nanotechnologies.

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

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Published by BSI Standards Limited 2019

ISBN 978 0 580 91394 5

ICS 07.120

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This Published Document was published under the authority of the Standards Policy and Strategy Committee on 30 June 2019.

Amendments/corrigenda issued since publication

Date	Text affected

PD ISO/TS 20660:2019

TECHNICAL SPECIFICATION

ISO/TS 20660

First edition
2019-06

Nanotechnologies — Antibacterial silver nanoparticles — Specification of characteristics and measurement methods

Nanotechnologies — Nanoparticules d'argent antibactériennes — Spécification des caractéristiques et des méthodes de mesure

Reference number
ISO/TS 20660:2019(E)

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Published in Switzerland

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Foreword

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

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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*.

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

Silver nanoparticles have become one of the most widely utilized nanomaterials in consumer products for their antibacterial properties. The application of silver nanoparticles is increasingly being adopted in consumer products to control the growth of microorganisms on the surfaces or interiors of products. When silver nanoparticles interact with microorganisms silver ions are released, and these ions may affect and damage microorganisms in different ways. However, the mechanism behind the bactericidal effect is not well known[1]. There have been several possible mechanisms proposed in the scientific literature: 1) silver ions with positive electricity released from silver nanoparticles are able to rapidly bind to sulfhydryl groups on the surfaces of bacteria, which leads the structures of bacteria to change and become damaged, 2) the uptake of silver ions or small nanoparticles disrupts adenosine triphosphate production and DNA replication, and 3) silver nanoparticles and ions generate reactive oxygen species resulting in oxidative damage[2]-[4]. Other scientific evidence of the antibacterial performance of silver nanoparticle is listed in Annex B. The antibacterial properties of silver nanoparticles are related to their physicochemical characteristics.

Although antibacterial products that utilize silver nanoparticle are widely distributed in the market, most of these products are sold without providing information on the physicochemical and corresponding antibacterial characteristics of nanoparticles. Currently, most manufacturers provide specifications based on their own practices.

This document provides guidance for the specification of characteristics and relevant recommended measurement methods, referenced from other standards for silver nanoparticles in powder and colloidal forms that are intended for antibacterial applications in nanotechnology. The major measurement methods available to industry for the determination of parameters specified in this document are of course recommended in the specification. This document reviews selected measurement methods that are commonly used at present, and therefore will require updating on a regular basis.

Nanotechnologies — Antibacterial silver nanoparticles — Specification of characteristics and measurement methods

1 Scope

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 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.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the cited edition applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 26824, *Particle characterization of particulate systems — Vocabulary*

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

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 26824, ISO/TS 80004-1, ISO/TS 80004-2 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
silver nanoparticle
nanoparticle composed of silver with all three external dimensions in the nanoscale

[SOURCE: modified from ISO/TS 80004-2, 4.1, modified]

3.2
primary particle
Original source *particle* (3.1) of *agglomerates* (3.4) or *aggregates* (3.5) or mixtures of the two

Note 1 to entry: *Constituent particles* (3.3) of agglomerates or aggregates at a certain actual state may be primary particles, but often the constituents are aggregates.

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

[SOURCE: ISO 26824, 1.4]