PD ISO/TS 20477:2023



BSI Standards Publication

Nanotechnologies — Standard terms and their definition for cellulose nanomaterial

bsi.

National foreword

This Published Document is the UK implementation of ISO/TS 20477:2023. It supersedes PD ISO/TS 20477:2017, which is withdrawn.

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 committee manager.

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

This publication is not to be regarded as a British Standard.

© The British Standards Institution 2023
Published by BSI Standards Limited 2023

ISBN 978 0 539 23230 1

ICS 01.040.07; 07.120

Compliance with a Published Document cannot confer immunity from legal obligations.

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 30 June 2023.

Amendments/corrigenda issued since publication

Date	Text affected

PD ISO/TS 20477:2023

TECHNICAL SPECIFICATION

ISO/TS 20477

Second edition
2023-05-11

Nanotechnologies — Vocabulary for cellulose nanomaterial

Nanotechnologies — Vocabulaire pour les nanomatériaux à base de cellulose

Reference number
ISO/TS 20477:2023(E)

© ISO 2023



COPYRIGHT PROTECTED DOCUMENT

© ISO 2023, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
3.1 Core nanotechnology terms related to cellulose nanomaterials 1
3.2 Prerequisite non-nanotechnology terms related to cellulose nanomaterials 2
3.3 Terms related specifically to cellulose nanomaterials 3
Annex A (informative) **Images of cellulose nanomaterials** **5**
Annex B (informative) **Cellulose micromaterials** **7**
Bibliography **8**
Index 8

© ISO 2023 – All rights reserved

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 document 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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*.

This second edition cancels and replaces the first edition (ISO/TS 20477:2017), which has been technically revised.

The main changes are as follows:

— some existing definitions have been revised;

— new terms and definitions have been introduced;

— micrographic images of cellulose nanomaterials have been introduced to illustrate some of the defined terms.

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.

© ISO 2023 – All rights reserved

Introduction

Cellulose is a polymer produced in nature. In plants, animals, algae and bacteria, cellulose is extruded from terminal enzyme complexes (TC). TCs are made up of many identical subunits, each containing at least one catalytic site from which a single cellulose chain is synthesized. Cellulose chains from a single TC combine to form an elementary fibril. As TCs in plants, animals, algae and bacteria have different numbers and configurations of subunits, the elementary fibrils they produce have different geometries. [1] Whether cellulose nanomaterials are separated by industrial processes or produced directly by organisms, they all contain a common structural component, which is the elementary fibril. This common component, the elementary fibril, provides a way to describe cellulose nanomaterials from all manufacturing methods and cellulose sources.

Cellulose nanomaterials can be manufactured industrially by conversion of wood pulp through chemical, biological or mechanical processes. Bacterium-based cellulose nanomaterials are produced directly by bacteria and can be further acid-hydrolysed to smaller dimensions. Besides trees and bacteria, algae are another potential source of cellulose nanomaterials for industrial applications. Owing to their unique properties and renewable nature, cellulose nanomaterials have developed into platform materials that have application potential in a wide range of products including those that currently utilize petroleum-based ingredients.

At the current stage of development, several terms that describe cellulose nanomaterials coexist and have created confusion among users. The difficulty of measuring sizes in the low micrometre and nanometre scale has given rise to confusion in the classification of materials, particularly for the fibrillate materials. Rather than delaying standards development until knowledge accumulated with research advancement and market maturity, there is an opportunity to define a standard vocabulary for cellulose nanomaterials, and for clarity, describe micro-scale cellulose materials, as given in Annex B. Although terms in the ISO/IEC 80004 series were not developed for specific types of nanomaterials such as cellulose nanomaterials, to be consistent with existing ISO/TC 229 hierarchy, this document utilizes terms from the ISO/IEC 80004 series. It is anticipated that as the market for cellulose nanomaterials matures, so too will the standard vocabulary. Beginning to define a standard vocabulary now will facilitate future communication, eliminate confusion, remove trade barriers, and provide policy makers and regulators with a set of consensus-based terms.

© ISO 2023 – All rights reserved

Nanotechnologies — Standard terms and their definition for cellulose nanomaterial

1 Scope

This document defines terms and definitions for different types of cellulose nanomaterials including secondary components found in cellulose nanomaterials originating from their manufacturing processes. This document also provides information on cellulose micromaterials in Annex B.

Where necessary, terms from the ISO/IEC 80004 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).

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

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

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

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

3.1 Core nanotechnology terms related to cellulose nanomaterials

3.1.1
nanoscale
length range approximately from 1 nm to 100 nm

Note 1 to entry: Properties that are not extrapolations from larger sizes are predominantly exhibited in this length range.

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

3.1.2
nanomaterial
material with any external dimension in the *nanoscale* (3.1.1) or having internal structure or surface structure in the nanoscale

Note 1 to entry: This generic term is inclusive of *nano-object* (3.1.3) and *nanostructured material* (3.1.5).

Note 2 to entry: See also definitions of engineered nanomaterial, manufactured nanomaterial and incidental nanomaterial in ISO/TS 80004-1:2015.

[SOURCE: ISO/TS 80004-1:2015, 2.4, modified — Note 2 to entry has been added.]

3.1.3
nano-object
discrete piece of material with one, two or three external dimensions in the *nanoscale* (3.1.1)

Note 1 to entry: The second and third external dimensions are orthogonal to the first dimension and to each other.

© ISO 2023 – All rights reserved