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## Nanotechnologies — Vocabulary for cellulose nanomaterial

*Nanotechnologies — Vocabulaire pour les nanomatériaux à base de  
cellulose*



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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 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](http://www.iso.org/directives)).

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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](http://www.iso.org/members.html).

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## 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.