



BSI Standards Publication

**Nanotechnologies — Carbon nanotube
suspensions — Specification of characteristics
and measurement methods**

National foreword

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Spécification de caractéristiques et méthodes d'essais*



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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*.

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

Carbon nanotubes (CNT) have attracted great interest due to their wide scope of possible applications, such as composite reinforcement material, hydrogen containers, super-capacitors, molecular sensors and scanning probe tips. Offering attractive mechanical, electric and thermal properties, CNTs could achieve a significant improvement in bulk properties by adding low weight percentages.

The performance of nano-objects can be degraded with the formation of agglomerates or aggregates in post-processing. Suspensions of the appropriate fluids and additives will stabilize nano-objects, preventing agglomeration and reducing losses to the environment during handling. It is widespread practice in the manufacturing industry to pre-treat nano-objects by making suspensions before delivery to the downstream customers. Industrial products based on CNT suspensions are a good example.

Since CNT suspensions containing multi-walled carbon nanotubes (MWCNTs) are widely supplied nowadays, it is timely to develop appropriate specifications. Such specifications would facilitate the communication between interested parties and the commercialization of CNT suspensions, and help to generate consistent performance in the final products.

A number of characterization documents related to CNT have been developed by ISO/TC 229, in which measurement methods and procedures for characteristics including morphology, impurities, volatile components, etc. are specified. This document specifies the characteristics to be measured of CNT suspension samples and describes their measurement methods. ISO/TR 10929 describes the characteristics to be measured of bulk samples of MWCNTs and their measurement methods. ISO/TR 13097 provides guidelines on how to characterize the stability of suspensions. It includes general guidance on how to specify the suspension in terms of its physical and chemical characteristics, which might affect its performance or subsequent processing.

Nanotechnologies — Carbon nanotube suspensions — Specification of characteristics and measurement methods

1 Scope

This document specifies the characteristics to be measured of suspensions containing multi-walled carbon nanotubes (CNT suspensions). It includes the essential and additional characteristics of the CNT suspension, and the corresponding measurement methods.

Characteristics specific to health, environmental and safety issues are excluded from this document.

WARNING — The use of this document can involve hazardous materials, operations and equipment. It does not purport to address all of the safety or environmental problems associated with its use. The execution of this document is entrusted to appropriately qualified and experienced people.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions 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/>

3.1.1

agglomerate

collection of weakly or medium strongly bound particles where the resulting external surface area is similar to the sum of the surface areas of the individual components

[SOURCE: ISO/TS 80004-2:2015, 3.4, modified — Notes 1 and 2 to entry have been deleted.]

3.1.2

aggregate

particle comprising strongly bonded or fused particles where the resulting external surface area is significantly smaller than the sum of surface areas of the individual components

[SOURCE: ISO/TS 80004-2:2015, 3.5, modified — Notes 1 and 2 to entry have been deleted.]

3.1.3

carbon nanotube

CNT

nanotube composed of carbon

Note 1 to entry: Carbon nanotubes usually consist of curved graphene layers, including single-wall carbon nanotubes and multi-walled carbon nanotubes.

[SOURCE: ISO/TS 80004-3:2010, 4.3]