



# TECHNICAL SPECIFICATION

---

**Nanotechnologies – Vocabulary –  
Part 9: Nano-enabled electrotechnical products and systems**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

**Warning! Make sure that you obtained this publication from an authorized distributor.**

## CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 Normative references .....	6
3 Terms and definitions .....	6
3.1 General terms related to nano-enabled electrotechnical products and systems .....	6
3.2 Terms related to nano-enabled photovoltaics and thin-film organic electronics .....	8
3.3 Terms related to luminescent nanomaterials .....	9
Alphabetical index.....	10
Bibliography.....	11

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

---

**NANOTECHNOLOGIES – VOCABULARY –****Part 9: Nano-enabled electrotechnical products and systems**

## FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

The main task of IEC technical committees is to prepare International Standards. In exceptional circumstances, a technical committee may propose the publication of a technical specification when

- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical Specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 80004-9, which is a Technical Specification, has been prepared by IEC technical committee 113: Nanotechnology for electrotechnical products and systems, in co-operation with ISO technical committee 229: Nanotechnologies.

It is published as a double logo Technical Specification.

The text of this standard is based on the following documents:

Enquiry draft	Report on voting
113/315/DTS	113/335/RVC

Full information on the voting for the approval of this Technical Specification can be found in the report on voting indicated in the above table. In ISO, the Technical Specification has been approved by 23 P members out of 37 having cast a vote.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the 80004 Technical Specification, published under the general title *Nanotechnologies – Vocabulary*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- transformed into an International Standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

## INTRODUCTION

Nanotechnology advances have profound implications in all branches of engineering and science and have a noticeable impact on established industries by introducing technological innovation. Within the electrotechnical industry, nanotechnologies play an important role as regards the miniaturization and the integration of electronic components as well as the fabrication of electrical devices with novel functionalities and improved performances.

There is a substantial investment in research that will bring development and wide diffusion of new nanomaterials, devices and systems. Examples include nanoscale interconnects made with carbon nanotube bundles and graphene nanoribbons to replace copper and overcome physical and performance limits in integrated electronics. Carbon-based nanostructures are promising for nanoscale transistors in post-silicon electronics, enabling higher integration and faster switching speeds and lighting devices with more efficient and powerful electron emission. Nanoscale sensors and nano-electromechanical systems are also being widely investigated.

Recent progress in the synthesis of nanomaterials and composites with nanoscale phases offers real opportunities for application in electrochemical systems-technology to obtain, for example, more efficient and inexpensive fuel cells and nano-enabled lithium ion batteries with extended capacity. High energy storage capacity, reaching and exceeding that of modern batteries, is the target of new ultra-capacitors exploiting state-of-the-art nanotechnology. Developments in solar cells via nanostructures are intended to reduce costs as well as improve the conversion efficiency. The aforementioned products are just some electrotechnical examples that exploit nanotechnologies and are in rapid and constant evolution.

However, such a fast moving technology, as well as its high multidisciplinary nature, inevitably generates a multiplicity of new scientific and technical terms often with ambiguous definitions. The objective of this document is the compilation of a list of terms and definitions useful for persons operating in the field of nanotechnologies and in the production of electrotechnical products and systems.

## **NANOTECHNOLOGIES – VOCABULARY –**

### **Part 9: Nano-enabled electrotechnical products and systems**

#### **1 Scope**

This document specifies terms and definitions for electrotechnical products and systems reliant on nanomaterials for their essential functionalities. It is intended to facilitate communications between organizations and individuals in industry and those who interact with them.

#### **2 Normative references**

There are no normative references in this document.