SLOVENSKI STANDARD
SIST EN 62607-3-1:2014

01-december-2014

Nanoproizvodnja - Ključne značilnosti - 3-1. del: Luminescenčni nanomateriali - Kvantna učinkovitost

Nanomanufacturing - Key control characteristics - Part 3-1: Luminescent nanomaterials - Quantum efficiency

Nanofertigung - Schlüsselmerkmale - Teil 3-1: Lumineszierende Nanomaterialien - Quanteneffizienz

Nanofabrication - Caractéristiques de contrôle clé Partie 3-1: Nanomatériaux luminescents - Rendement quantique

Ta slovenski standard je istoveten z: **EN 62607-3-1:2014**

ICS:

07.120	Nanotehnologije	Nanotechnologies

SIST EN 62607-3-1:2014 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 62607-3-1

August 2014

ICS 07.030

English Version

Nanomanufacturing - Key control characteristics - Part 3-1: Luminescent nanomaterials - Quantum efficiency (IEC 62607-3-1:2014)

Nanofabrication - Caractéristiques de contrôle clé Partie 3-1: Nanomatériaux luminescents - Rendement quantique (CEI 62607-3-1:2014)

Nanofertigung - Schlüsselmerkmale - Teil 3-1: Lumineszierende Nanomaterialien - Quanteneffizienz (IEC 62607-3-1:2014)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 62607-3-1:2014 E

Foreword

The text of document 113/214/FDIS, future edition 1 of IEC 62607-3-1, prepared by TC 113 "Nanotechnology standardization for electrical and electronic products and systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62607-3-1:2014.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2015-03-26
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2017-06-26

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Annex ZA
(normative)
Normative references to international publications with their corresponding European publications

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

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
CIE S 017/E	2011	ILV: International Lighting Vocabulary	-	-

IEC 62607-3-1

Edition 1.0 2014-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Nanomanufacturing – Key control characteristics
Part 3-1: Luminescent nanomaterials – Quantum efficiency

Nanofabrication – Caractéristiques de contrôle clé
Partie 3-1: Nanomatériaux luminescents – Rendement quantique

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX **V**

ICS 07.030

ISBN 978-2-8322-1605-7

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CONTENTS

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NANOMANUFACTURING – KEY CONTROL CHARACTERISTICS

Part 3-1: Luminescent nanomaterials – Quantum efficiency

FOREWORD

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International Standard IEC 62607-3-1 has been prepared by IEC technical committee 113: Nanotechnology standardization for electrical and electronic products and systems.

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

FDIS	Report on voting
113/214/FDIS	113/219/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

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

A list of all parts of the IEC 625607 series, published under the general title *Nanomanufacturing – Key control characteristics,* can be found on the IEC website.

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

One of the principal drivers of solid-state lighting (SSL) is the potential efficiency of the illumination devices to convert electricity into light. Incandescent and fluorescent lighting devices are only about 5 % to 30 % efficient, with incandescent lighting having the lowest efficiency. Since a significant portion of all electricity consumed is used in providing lighting, increasing the efficiency of lighting devices will have a huge impact on the world's energy consumption. The luminous efficiency of SSL devices is a critical measurement of their overall efficiency, and standard methods to perform these measurements have been established and were essential to producing reliable product information for manufacturers and consumers. The same is true of the luminescent materials on which these light-emitting diode (LED) manufacturers rely; however, no such standard currently exists. This standard provides SSL manufacturers a universal means for comparing luminescent nanomaterials from different suppliers, and potentially for luminescent materials for LEDs in general.

The most common SSL devices are composed of a blue light-emitting diode (LED) and a luminescent material. The blue LED optically excites the luminophore, which will radiate light of the appropriate colour or colours to yield the desired white spectrum. This device, termed a phosphor-converted light emitting diode (or pc-LED), converts the electricity indirectly into white light by first creating blue light and then converting the blue light into broad-band visible radiation. Currently, quantum dots (QDs) or nanophosphors are one option for the photoluminescent material that converts the blue LED wavelength to broad spectrum visible light. QDs and nanophosphors are of interest in this application for several reasons including their greater colour flexibility, narrowband emission spectrum, broadband absorption, near-infinite flocculation time, reduced bleaching, and lower scattering compared to conventional phosphors which are typically larger than 5 µm. QD-enabled pc-LEDs have been shown to have the best possible combination of colour rendering, correlated colour temperature, and luminous efficiency of any other pc-LED on the market.

A critical measurement parameter for luminescent materials used in the lighting industry is quantum efficiency, which is defined in this standard as the number of photons emitted into free space by a luminescent nanoparticle divided by the number of photons absorbed by the nanoparticle. Suppliers of QDs and luminescent nanomaterials typically measure only relative quantum efficiency (or alternatively, quantum yield) in the solution phase due to the ease of such measurements and the applicability of such measurements to biomedical imaging (a widespread use of QDs in R&D). These measurements are often taken at low concentrations where effects such as nanoparticle agglomeration and re-absorption are minimized. However, in end-use applications, the actual concentration of luminescent nanomaterials may be significantly different. For example, concentrated luminescent nanoparticle formulations (in either solid or liquid state) may be required to achieve a desired luminous flux and correlated colour temperature in a SSL device. This standard codifies that method for the first time, and establishes an absolute quantum efficiency test method for both solid (e.g., luminescent nanoparticles embedded in polymer matrices, coated on glass optics, applied directly to light emitted diodes, and other form factors) and solution samples (e.g., colloidal suspensions of luminescent nanoparticles), enabling suppliers and purchasers to compare the performance of one material to another, both in their raw (solution) phase as well as their technologically relevant (solid) phase of matter.