IEC TS 62972

Edition 1.0 2016-07

TECHNICAL SPECIFICATION

SPECIFICATION TECHNIQUE

General lighting – Organic light emitting diode (OLED) products and related equipment – Terms and definitions

Éclairage général – Produits à diodes électroluminescentes organiques (OLED) et équipements associés – Termes et définitions

IEC TS 62972:2016-07(en-fr)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue
The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org
The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 15 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary
65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de l'IEC
La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC
Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Catalogue IEC - webstore.iec.ch/catalogue
Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - www.iec.ch/searchpub
La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,…). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished
Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org
Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 15 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary
65 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc
Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

IEC TS 62972

Edition 1.0 2016-07

TECHNICAL SPECIFICATION

SPECIFICATION TECHNIQUE

General lighting – Organic light emitting diode (OLED) products and related equipment – Terms and definitions

Éclairage général – Produits à diodes électroluminescentes organiques (OLED) et équipements associés – Termes et définitions

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.140.99 ISBN 978-2-8322-3468-6

Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

GENERAL LIGHTING – ORGANIC LIGHT EMITTING DIODE (OLED) PRODUCTS AND RELATED EQUIPMENT – TERMS AND DEFINITIONS

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 62972, which is a Technical Specification, has been prepared by subcommittee 34A: Lamps, of IEC technical committee 34: Lamps and related equipment.

The text of this Technical Specification is based on the following documents:

Enquiry draft	Report on voting
34A/1874/DTS	34A/1896/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.

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

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

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

GENERAL LIGHTING – ORGANIC LIGHT EMITTING DIODE (OLED) PRODUCTS AND RELATED EQUIPMENT – TERMS AND DEFINITIONS

1 Scope

This Technical Specification establishes terms and definitions specific for general lighting OLED light sources and related equipment.

2 Classification of terms

Terms specific for general lighting OLED light sources and related equipment are classified as follows:

a) fundamental terms;

b) terms related to physical properties;

c) terms related to constructive elements;

d) terms related to performance and specifications.

NOTE This classification is in line with IEC 62341-1-2:2014. However, the classification of terms related to the production process was removed.

3 Fundamental terms

3.1
organic light emitting diode
OLED
light emitting diode consisting of an electroluminescent zone made of organic compounds which are situated between two electrodes

Note 1 to entry: This note applies to the French language only.

3.2
polymeric organic light emitting diode
PLED
OLED where all the organic semiconductor materials are polymers

Note 1 to entry: This note applies to the French language only.

3.3
small molecule organic light emitting diode
SMOLED
OLED where all the organic semiconductor materials are small molecules

Note 1 to entry: This note applies to the French language only.

3.4
stacked OLED
OLED consisting of two or more emission layers and at least one charge generation layer between two emission layers

Note 1 to entry: There can be emission layers inside a stacked OLED that are not separated by a charge generation layer. However, at least one pair of emission layers is separated by a charge generation layer.

3.5
bottom emission OLED
OLED which emits light through the substrate side

3.6
top emission OLED
OLED which emits light through the encapsulation side

3.7
transparent OLED
OLED in which the light-emitting area is transparent in the off-state

3.8
inverted OLED
OLED where the substrate carries the cathode

3.9
hybrid organic light emitting diode
hybrid OLED
OLED that uses a hybrid OLED stack

3.10
bendable OLED
OLED designed for being bent into a permanent shape

3.11
flexible OLED
OLED designed for being repeatedly bent

3.12
OLED tile
smallest functional OLED light source which cannot be separated into smaller OLED lighting elements and containing at least one contact ledge with at least one positive and one negative pole for connection to the electrical power supply

3.13
OLED panel
independently operable unit OLED product containing one or more OLED tiles and means of connection to electrical supply such as a connector, PCB (printed circuit board), passive electronic components and optionally a frame

3.14
OLED module
assembly of one or more OLED panels and active electronic components

3.15
OLED lamp
OLED panel or OLED module with a cap

3.16
OLED light source
OLED tile, OLED panel, OLED module or OLED lamp

4 Terms related to physical properties

4.1
light output area
A_{LO}
area of an OLED tile, panel or module designed to emit light, including active luminous areas, busbars and other mechanical structures, but excluding edges

Note 1 to entry: The light output area is expressed in m^2.

4.2
active luminous area
A_{act}
area of an OLED tile, panel or module designed to emit light and including inner non-luminous areas due to defects, but excluding layout defined busbars and other mechanical structures

Note 1 to entry: The active luminous area is expressed in m^2.

4.3
aperture ratio
F
quotient of active luminous area and light output area

$$F = \frac{A_{act}}{A_{LO}}$$

Note 1 to entry: The aperture ratio is a quantity of dimension one.

4.4
luminous current efficacy
r
luminance divided by the applied current per unit area

Note 1 to entry: This term is sometimes incorrectly called "luminous current efficiency".

Note 2 to entry: The luminous current efficacy is expressed in cd/m^2.

4.5
emission ratio
luminous flux emitted by the side with the higher luminous flux divided by the luminous flux emitted by the side with the lower luminous flux

Note 1 to entry: This term is only used with transparent OLED panels.

Note 2 to entry: The emission ratio is a quantity of dimension one.

4.6
internal quantum efficiency
η_{IQE}
ratio of the number of photons generated inside an OLED to the number of electrons injected into the OLED

Note 1 to entry: An internal quantum efficiency greater than 100 % is possible if charge carriers are generated inside the OLED.

4.7
external quantum efficiency
η_{EQE}
quantity describing the yield of outcoupled photons with regard to injected charge carriers (electrons)

Note 1 to entry: The external quantum efficiency can be expressed as

$$\eta_{EQE} = \eta_{IQE} * \eta_{out}$$

where η_{out} is the outcoupling efficiency. η_{out} contains optical loss modes such as surface plasmon polaritons or waveguided modes.

Note 2 to entry: The external quantum efficiency is expressed in %.

4.8
outcoupling efficiency

η_{out}

quotient of the external quantum efficiency and the internal quantum efficiency

$$\eta_{out} = \frac{\eta_{EQE}}{\eta_{IQE}}$$

4.9
forward direction

F

direction of electrical current that results when the HIL/HTL side of the OLED stack (p-type region) connected to an electrode is on positive potential relative to the EIL/ETL side (n-type region) connected to the other electrode

Note 1 to entry: The forward direction is denoted by adding the subscript F to the symbol of the quantity concerned, for example forward current is denoted as I_F.

4.10
reverse direction

R

direction of electrical current when the HIL/HTL side of the OLED stack is connected to an electrical contact which is on negative potential with regards to the connection of the EIL/ETL side

Note 1 to entry: The reverse direction is denoted by adding the subscript R to the symbol of the quantity concerned, for example reverse current is denoted as I_R.

4.11
forward current

I_F

electrical current in forward direction

Note 1 to entry: The forward current is expressed in A.

4.12
forward voltage

U_F

potential difference pertaining to the forward direction, dependent on the forward current at a given temperature

Note 1 to entry: The forward voltage is expressed in V.

[SOURCE: IEC 62504:2014, 3.13, modified — Note 2 to entry has been deleted.]

4.13
reverse current

I_R

electrical current in reverse direction

Note 1 to entry: The reverse current is expressed in A.

4.14
reverse voltage
U_R
potential difference pertaining to the reverse direction dependent on the reverse current

Note 1 to entry: The reverse voltage is expressed in V.

4.15
uniformity
physical magnitude of change present in a spatial luminance or chromaticity distribution

Note 1 to entry: This definition does not take perception into account.

4.16
homogeneity
perceived magnitude of change present in a spatial luminance or chromaticity distribution

5 Terms related to constructive elements

5.1
fluorescent emitter
emitter where only the singlet state excitons can show radiative decay and photon emission

Note 1 to entry: A fluorescent emitter is a type of emitter material. According to spin statistics in quantum chemistry, excitons formed by an electron and a hole can have two different spin multiplicities, i.e. 1 (singlet state) or 3 (triplet state). Simply spoken, 25 % of the states are singlets and 75 % are triplets. In a fluorescent emitter only the singlet state excitons can show radiative decay and photon emission. The theoretical maximum of the internal quantum efficiency is 25 %.

5.2
phosphorescent emitter
emitter where singlet and triplet state excitons can show radiative decay and photon emission

Note 1 to entry: A phosphorescent emitter is a type of emitter material. According to spin statistics in quantum chemistry, excitons formed by an electron and an electron hole can have two different spin multiplicities, i. e. 1 (singlet state) or 3 (triplet state). Simply spoken, 25 % of the states are singlets and 75 % are triplets. In a phosphorescent emitter singlet and triplet state excitons can show radiative decay and photon emission.

5.3
hybrid OLED stack
OLED stack that uses more than one kind of material and/or processing method

Note 1 to entry: A hybrid OLED stack can be as follows, for example:

a) an OLED stack which contains fluorescent and phosphorescent emitters,

b) an OLED stack which contains polymer and small molecule layers,

c) an OLED stack which combines solution-processed and evaporated organic layers.

[SOURCE: IEC 62341-1-2:2014, 2.2.16, modified — The terms "hybrid organic light emitting diode" and /"hybrid OLED" were replaced with "hybrid OLED stack". The definition was modified to fit the term. List entry c) was added to the note.]

5.4
substrate
material to carry the OLED stack

Note 1 to entry: Most common is the use of glass, metal foils or polymer foils.

5.5
OLED stack
core element of an OLED to generate light, consisting of a multi-layer structure with significant lateral dimensions where each layer has a special functionality, the two

sandwiching layers at top and bottom being electrodes for connection to a power supply and at least one of these electrodes being transparent to enable light extraction

5.6
anode
<OLED stack> electrode from where holes are injected into the organic layers

5.7
cathode
<OLED stack> electrode from where electrons are injected into the organic layers

5.8
hole injection layer
HIL
layer adjacent to the anode and designed to improve the hole injection

Note 1 to entry: The HIL is part of the OLED stack.

Note 2 to entry: This note applies to the French language only.

5.9
electron injection layer
EIL
layer adjacent to the cathode and designed to improve the electron injection

Note 1 to entry: The EIL is part of the OLED stack.

Note 2 to entry: This note applies to the French language only.

5.10
hole transport layer
HTL
layer inside the OLED stack with a relatively high mobility of holes and used to adjust the charge carrier balance in the OLED stack

Note 1 to entry: The special case of an electrically doped HTL for further conductivity increase is called p-HTL.

Note 2 to entry: This note applies to the French language only.

5.11
hole blocking layer
HBL
layer inside the OLED stack with a relatively low mobility of holes or difference of highest occupied molecular orbital level and used to adjust the charge carrier balance in the stack

Note 1 to entry: This note applies to the French language only.

5.12
electron transport layer
ETL
layer inside the OLED stack with a relatively high mobility of electrons and used to adjust the charge carrier balance in the stack

Note 1 to entry: The special case of an electrically doped ETL for further conductivity increase is called n-ETL.

Note 2 to entry: This note applies to the French language only.

5.13
electron blocking layer
EBL
layer inside the OLED stack with a relatively low mobility of electrons and used to adjust the charge carrier balance in the OLED stack