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Nanomanufacturing — Reliability assessment

Part 4-1: Nanophotonic products — Optical stability test of quantum dot enabled light conversion films: Temperature, humidity and light exposure

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

NANOMANUFACTURING – RELIABILITY ASSESSMENT –

Part 4-1: Nanophotonic products – Optical stability test of quantum dot enabled light conversion films: Temperature, humidity and light exposure

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IEC TS 62876-4-1 has been prepared by IEC technical committee 113: Nanotechnology for electrotechnical products and systems. It is a Technical Specification.

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

Draft	Report on voting
113/866/DTS	113/886/RVDTS

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

The language used for the development of this Technical Specification is English.

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This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 62876 series, published under the general title *Nanomanufacturing – Reliability assessment*, 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 webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
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- revised.

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INTRODUCTION

Quantum dots (QDs), as luminescent nanomaterials, exhibit broad absorption spectra and narrow emission spectra. Using the same excitation source to excite QDs of different particle size, it is possible to emit spectra with different peak wavelengths. Based on the above characteristics, QDs are used in display products, which can greatly improve the display colour gamut.

Nowadays, as a typical product of quantum dot technology application, quantum dot enabled light conversion film (Q-LCF) is widely used in the display field. Under normal working conditions, Q-LCF in a backlight module will be continuously irradiated by high-energy excitation light (such as blue light) to emit converted light. Under the combined action of water vapour and oxygen from the environment, the optical properties of the QDs in Q-LCF will slowly deteriorate. In order to ensure the quality and stability of Q-LCF products, it is essential to scientifically design a reliability test standard to evaluate product quality. Reliability assessment can be used, for example, to authorize advancement to the next step in product development, or to authorize progress payments, or to proceed with delivery and acceptance of products.

This document provides reliability test and evaluation criteria for Q-LCF. In this document, Q-LCFs are used as the test objects. Accelerated aging tests containing stress factors of temperature, humidity, light are imposed on the test objects to obtain performance shift data and change trend.

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NANOMANUFACTURING – RELIABILITY ASSESSMENT –

Part 4-1: Nanophotonic products – Optical stability test of quantum dot enabled light conversion films: Temperature, humidity and light exposure

1 Scope

This part of IEC 62876, which is a Technical Specification, establishes a general reliability testing programme to verify the reliability of the performance of quantum dots nanomaterials, and quantum dot enabled light conversion films (Q-LCFs).

The Q-LCF is used as subassemblies for the fabrication of nano-enabled photoelectrical display devices, mainly liquid crystal display (LCD) currently, with other components.

This testing programme defines standardized aging conditions, methodologies and data assessment for Q-LCF product.

The results of these tests define a stability under standardized aging conditions for quantitative evaluation of the reliability of the Q-LCF.

The procedures specified in this document were designed for Q-LCF but can be extended to serve as a guideline for other kinds of light conversion films or related subassemblies as well.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068-2-1:2007, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-27:2008, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60068-2-78:2012, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC TS 62565-4-4:2025, *Nanomanufacturing – Product specifications – Part 4-4: Nanophotonic products – Blank detail specifications: Quantum dot enabled light conversion films*

IEC 62595-2-1:2016, *Display lighting unit – Part 2-1: Electro-optical measuring methods of LED backlight unit*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

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