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GB/T 42976-2023

Nanotechnology - Nano-enabled optoelectrical display - Measurement of optical performance for quantum dot enabled light conversion film

纳米技术 纳米光电显示 量子点光转换膜光学性能测试方法

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Standardization Administration of the PRC

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Foreword

This document was issued on 7 September 2023 by the State Administration for Market Regulation; Standardization Administration of the PRC and takes effect on 1 April 2024.

It is a GB/T standard: recommended rather than compulsory, but it is the text a Chinese reviewer applies when assessing a submission.

1 Scope

GB/T 42976-2023 covers the measurement of the optical performance of a quantum dot light conversion film, the film used in a nano-enabled optoelectrical display to turn the backlight into the light the panel puts out. It sets out the terms, definitions and symbols in use, the principle of the method, the instruments and the background test platform the film is measured on, how a test sample is chosen and cut, the test procedure beginning with debugging of the backlight system, the processing of the recorded data, and what the test report has to state. Two informative appendices add a variant of the method built around an integrating sphere, and a worked example of a film measured end to end. What is being protected here is comparability: luminance and haze readings depend on the backlight, on

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the measuring geometry and on the condition of the sample, so a figure quoted by one supplier and a figure quoted by another describe nothing in common unless the whole chain is fixed. Samples that curl or crack, or that carry scratches or dirt on the cut surface, are kept out for the same reason. Of use to quantum dot film producers, backlight and display module makers, and the laboratories that qualify incoming material.

This document describes the test method for the optical performance of quantum dot light conversion films, including method principles, instruments and equipment, test samples, test procedures, data processing and test report, etc.

This document is applicable to the measurement of the optical performance of quantum dot light conversion films for liquid crystal display devices. The measurement of the optical performance of other types of light conversion films may take this as a reference.

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2 Normative References

The contents of the following documents constitute indispensable clauses of this document through the normative references in the text. In terms of references with a specified date, only versions with a specified date are applicable to this document. In terms of references without a specified date, the latest version (including all the modifications) is applicable to this document.

GB/T 2410-2008 Determination of the Luminous Transmittance and Haze of Transparent Plastics

GB 19510.1-2009 Lamp Controlgear - Part 1.General and Safety Requirements

GB/T 20147 CIE Standard Colorimetric Observers

GB/T 37664.1-2019 Nanomanufacturing - Key Control Characteristics - Luminescent Nanomaterials - Part 1.Quantum Efficiency

3 Terms and Definitions

The terms and definitions defined in GB/T 37664.1-2019, and the following are applicable to this document.

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3.1 quantum dot

Nanoparticles that exhibit size-dependent properties due to the quantum confinement effect of

electronic states.

[source. GB/T 32269-2015, 4.7]

3.2 quantum dot light conversion film; Q-LCF

An optical film that converts high-energy photons of a specific wavelength into low-energy

photons of another or several wavelengths through quantum dots.

3.3 peak wavelength

The wavelength corresponding to the maximum peak intensity in the spectrum.

NOTE. the fluorescence emission spectrum of quantum dot light conversion films usually has

multiple emission peaks, and each emission peak corresponds to the peak wavelength of a

quantum dot.

3.4 quantum yield

The photon emission efficiency of luminescent materials.

NOTE. it is the ratio of the number of emitted photons to the number of absorbed photons.

[source. GB/T 36081-2018, 3.2, modified]

3.5 haze

The ratio of the scattered luminous flux that deviates from the direction of the incident light

and passes through the specimen to the transmitted luminous flux.

NOTE 1.it is expressed in percentage.

NOTE 2.in this document, only scattered luminous flux that deviates from the direction of incident

light by more than 2.5? is used to calculate haze.

[source. GB/T 2410-2008, 3.1, modified]

3.6 luminous transmittance

The ratio of the luminous flux passing through the specimen to the luminous flux irradiating

the specimen.

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NOTE. it is expressed in percentage.

[source. GB/T 2410-2008, 3.2, modified]

3.7 luminance uniformity

The ratio of the minimum luminance to the maximum luminance in the test area of the quantum

dot light conversion film.

3.8 color non-uniformity

The maximum chromaticity deviation value between the center and non-center of the test area

of the quantum dot light conversion film.

3.9 light conversion efficiency; LCE

The ratio of the number of fluorescent photons emitted by the quantum dot light conversion

film to the number of absborbed photons of the backlight.

3.10 photon absorptance; PA

The ratio of the number of backlight photons absorbed by the quantum dot light conversion

film to the number of backlight photons.

3.11 full width at half maximum; FWHM

The peak width at half the light intensity of the peak wavelength.

4 Symbols

The following symbols are applicable to this document.

H. haze

L. luminance

Lu. luminance uniformity

Lmin. minimum luminance

Lmax. maximum luminance

T. transmittance

WF. full width at half maximum

?p. peak wavelength

(x, y). CIE 1931 standard colorimetric system, chromaticity coordinates

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