

Quantum dot particles for linearly polarized LCD backlights, Kristiaan Neyts

Paper Title:

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Topics of Scope Preference:

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Scope:

1. Quantum Dots and Nano-Phosphor materials
2. Quantum Dot Light Emitting Diode
3. Application and Related Materials

Presentation Style Preference:

Your presentation preference must be indicated (by invitation). The final decision will be made by the Program Committee.

Originality and novelty

In this work we describe the use of particles based on quantum dots to generate linearly polarized light. Quantum dots embedded in nanorods made of a material with a higher bandgap can efficiently absorb light from a blue LED and convert it to red and green light that is to a large degree linearly polarized. A polymer layer doped with aligned nanorods is an excellent light source for an LCD backlight.

Impact

Normally the linear polarizer in an LCD display absorbs an important fraction of the illumination from the backlight. By using a backlight with aligned nanorods, the backlight emits mainly polarized light and reduces the losses in the LCD panel. This leads to an important increase in efficiency in QLED screens.

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Body of Abstract

Semiconductor quantum dots can provide narrow-band photoluminescence with dominant wavelength determined by the size of the quantum dots. Core-shell particles with an elongated shell that are aligned with each other, can yield linearly polarized red or green light by down-conversion of blue. The shell typically has a larger band gap that effectively absorbs the photons emitted by a blue LED. The electron-hole pair is transferred to the quantum dot core, which has a smaller band gap than the shell. The semiconductor particle with the embedded quantum dot can be aligned by an electric field when it is dispersed in a non-polar solvent or in liquid crystal. After polymerization a thin film is observed with provides linearly polarized light. By aligning this layer with the direction of transmission of the polarizer of an LCD panel, the losses in the polarizer can be reduced considerably. Based on this approach an LCD with highly saturated red and blue colors and low losses in the polarizers should become a possibility.

Prior publications

- [1] Aubert T, Paangetic L, Mohammadimasoudi M, Neyts K, Beeckman J, Clasen C, et al., Large-Scale and Electroswitchable Polarized Emission from Semiconductor Nanorods Aligned in Polymeric Nanofibers. *Acs Photonics* 2015, 2(5): 583-588.

In this prior publication we explain how nanorods can be aligned in nanofibers, and how the polarization of the emission can be switched. In our new work we consider aligned nanorods that are fixed to provide linear polarization with a fixed direction.

- [2] Mohammadimasoudi M, Beeckman J, Hens Z, Neyts K. Hybrid fluorescent layer emitting polarized light. *Apl Mater* 2017, 5(7).

In this prior publication we explain how nanorods may be embedded in a liquid crystal layer and aligned without aggregations in a thin polymer film. In our new work we investigate how such layer may be improved and used in a backlight for LCDs. them.

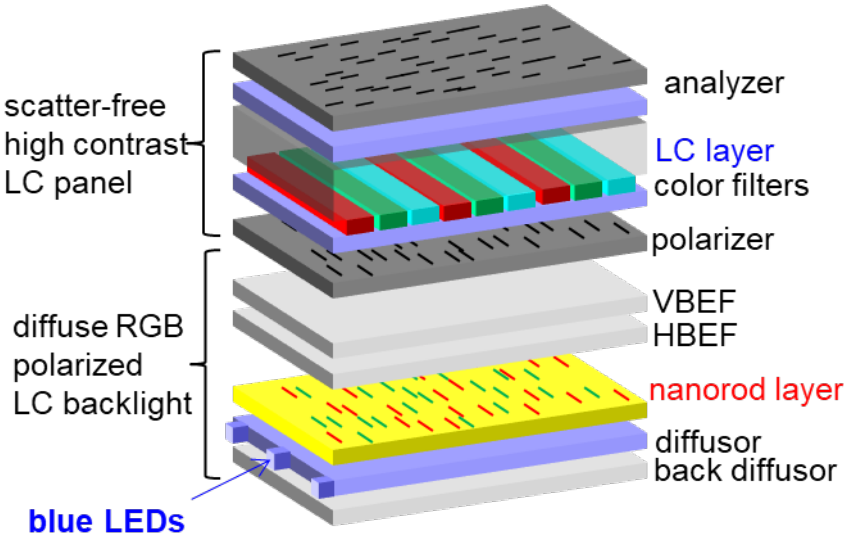


Fig. 1. Structure of a LCD display based on edge lit LEDs and aligned nanorod layer as polarized backlight.