# Efficiently Fabricated Quantum Dot Film by Polymer-free Nanoparticles Adhesion Technique for Down-conversion of Blue Light in Organic Light Emitting Diode

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Recent research development of organic light-emitting diodes (OLEDs) promising in electron to photon conversion process efficiently with high color-rendering quality and soft which benefits the commercialization of wide area display and solid-state lighting devices [1]. White OLEDs source could be constructed by blue OLEDs (BOLEDs) with remote phosphor or RGB stacked OLEDs, in reliability aspect BOLEDs is better than RGB stacked electroluminescent (EL) device which demands many organic functional layers with different lifetime results low reliability. BOLEDs with remote Phosphor could make device simpler and hybrid of EL and photoluminescence (PL) system, but poor color-rendering quality due to wide emission spectrum of Phosphor. In this work we choose BOLEDs with Quantum Dots (QDs) which is stable, hybrid and encounter high color-rendering quality due to sharp emission (FWHM < 40 nm) of QDs by Down-conversion mechanism. Down-conversion of blue Photon from BOLEDs by QDs require high quality of QDs color-conversion film with thin, efficiently dispersed, non-agglomerated. However, fabricating thin and well dispersed QDs films were challenging and conventional Drop-casting or Spin-coating method uses dense Polymer as matrix, hence not efficient for Down-conversion of Photons. Polymer matrix increases the Nanoparticle agglomeration and results haze effect [2].

To address this problem we introduced 'Polymer-free Nanoparticles Adhesion Technique' by simple Spin-coating on Teflon plate and transfer to OCA film (25 μm) which extends the efficient fabrication of thinner, Polymer free, well dispersed and non-agglomerated QDs film for efficient Down-conversion of Photons. In experimental investigation, BOLED emission λ= 460 nm, Area 2x2 $cm^2$ as blue Photon source, homemade CdSe/CdS/ZnS red QDs were synthesized with slight modification as reported [3] and Alumina ($Al_2O_3$) micro particles were used.

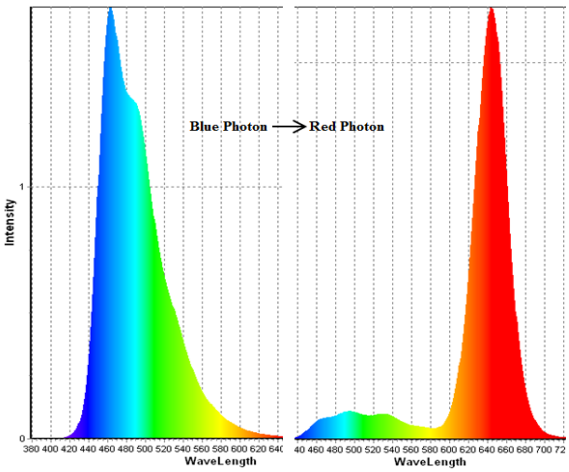


**Fig. 1. EL Spectrum of Photon Down-conversion**

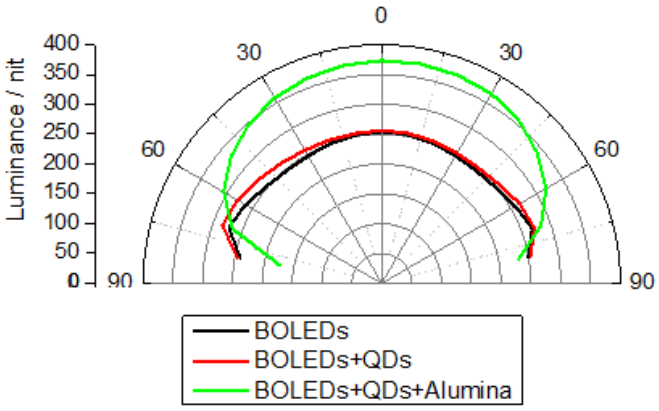


**Fig. 2. Lambertion Emission Patterns of QDs film**

The efficient down conversion of blue Photon to Red were realized through EL spectrum shown in Figure 1, and the achieved enhancement were 3% (253 to 260 nit) it was further enhanced to 29% (253 to 325 nit) through outcoupling process by attaching Alumina ($Al_2O_3$) micro particle on QDs film. The Lambertion emission pattern shown in Figure 2, which is efficient and superior than the typical results of Polymer matrix QDs film.

The QDs films were critically investigated further such as the internal and external morphologies by HRXRD, HRTEM as well as optical properties by UV-visible Absorption spectrum, PL fluorescence mode and Quantum Yield. There were ongoing investigations of material process and technical optimization for the best attainment.

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