Improved Performance of CdSe/ZnS Quantum Dots Light-Emitting Devices by Atomic Surface Modulation

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Quantum dot light-emitting diode (QLED) has received attention as the next generation display, replacing LCD (liquid crystal display) and OLED (organic light-emitting diode), because quantum dots(QDs) used for electroluminescence (EL) devices allow for both the tuning of the emission color by changing the QD size and enhanced color purity with a full width at half-maximum (FWHM), as narrow as 18 to 25 nm in the visible range. In addition, it is possible to simplify the solvent process using a spin casting or contact printing method; either of which allow for QLED to meet a broad region of standards set by the National Television System Committee (NTSC). Recently, many researchers reported on QLEDs manufactured using TiO_2 nanoparticles (NPs) as the electron transport layer (ETL) and confirmed the probability of a solution process. These reports showed well describe the energy transfer between metal-oxide NPs and cathode[1,2]. However, the effect of interface between QDs and ZnO NPs by through cetyl trimethylammounium bromide (CTAB) treatment was not yet reported. The bromide (Br^-) halide anion of CTAB could be provides not only reducing CdSe/ZnS QDs inter-particle spacing but also increasing carrier transport from ZnO NPs.

In this study, to evaluate effect on halide Br^- anion on CdSe/ZnS QDs as shortly inorganic ligands, we adopted CTAB and the halide anion of Br^- was coordinated on CdSe/ZnS QD film by nucleophilic nature. Then, we fabricated solution processible QLED by previous modified methods. Consequently, the QLED with CTAB (Br-QLED) was shown a maximum luminance of 36,000 cd/m^2 and achieved a maximum external current efficiency of 9.5 cd/A. The luminance and external current efficiency were enhanced by over 1.6 times compared to QLED without CTAB (Ref-QLED).

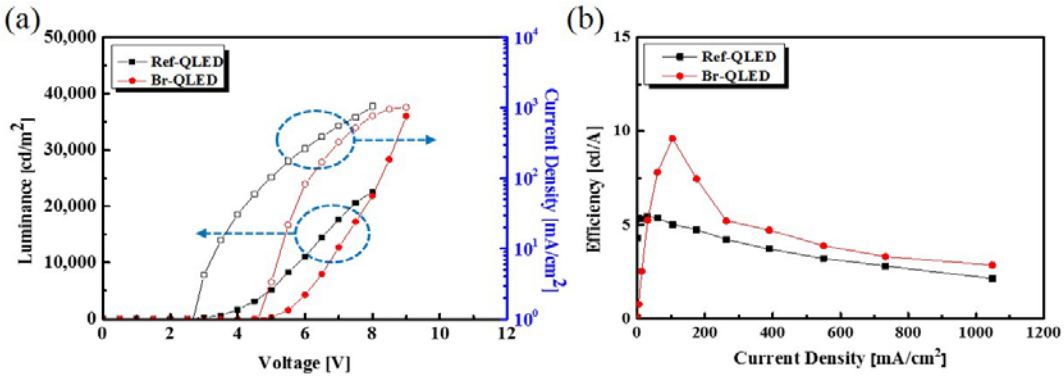

Fig. 1. The results of fabricated QLEDs performance.
(a) Luminance and current density, and (b) current density-current efficienc

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References

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