Ultraviolet Electroluminescence Devices Using CdZnS/ZnS Quantum Dots

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Collidal quantum dots (CQDs) are of interest to scientific and industrial researchers owing to the unique optical properties including high photoluminescence quantum yields, narrow emission spectral bandwidths, and color tunability. Owing to the advantages, recently, liquid crystal displays (LCDs) using CQDs as the red and green phosphors have been commercialized. In addition to the advances, the electroluminescence from the CQDs has been widely investigated as the candidate for the next-generation display devices[1–3]. Recent reports show that the efficiency and stability of CQD-based light-emitting diodes (QLEDs) are now comparable to organic light-emitting diodes (OLEDs) using phosphorescent materials[2]. For the QLEDs, however, it is still hard to fabricate deep blue-emitting devices due to the poor hole injection from the highest occupied molecular orbital (HOMO) energy levels of organic hole transport layer (HTL) to deep valence band (VB) energy levels of wide-gap CQDs. In order to overcome the issue, an inverted device structure was introduced[1], enabling to fabricate high energy light-emitting devices.

In this work, we demonstrate ultraviolet (UV) light-emitting QLEDs with a peak wavelength down to 377 nm in an inverted device structure which can facilitate hole injection into CQDs. So far, thin-film based UV LEDs have been introduces using organic molecules[4] or metal oxides[5]. But they exhibited much lower radiance than GaN-based UV LEDs. Also, they show wide spectral bandwidths including visible emission. On the other hands, the UV QLEDs show a high power density with narrow emission only in UV region. Thus, the UV QLEDs can be used in various applications as the light source for counterfeit detection, photo-polymerization, and photo-excitation. We would like to introduce a synthetic method of UV-emitting alloyed CdZnS/ZnS CQDs as well as the UV QLEDs in this presentation.

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