Increased Electrical Conductivity of Electron Transport Layer of InP Quantum Dot-Based Light-Emitting Diodes

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Colloidal ZnO nanoparticles (NPs) is mainly used as an electron transport layers (ETLs) for quantum dot light-emitting diodes (QD-LEDs) due to their moderate electron mobility, wide band gap, and transparency in the visible region. We have investigated the effects of increased electrical conductivity of the ETL on InP-based QD-LEDs. In order to increase the electrical conductivity of the ZnO, Al was doped into ZnO. By doping Al into ZnO, electron density of ZnO was increased and it leads to an increase in n-type electrical conductivity of ZnO. Al-doped ZnO was synthesized by controlling molar ratios Al to Zn, and analyzed using UV absorption, photoluminescence (PL), and TEM. In addition, current density-voltage-luminance (J-V-L) analysis of Al-doped ZnO applied InP-based QD-LED was conducted. As the Al to Zn ratio of Al-doped ZnO increases, the band gap energy slightly increases. Defect emission of Al-doped ZnO was effectively suppressed resulting in increase of EQE of the Al-doped ZnO applied InP-based QD-LED.