Recent Progress of IJP EL-QD Display with Cd-free QD inks

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Abstract

Quantum dot (QD) materials have attracted considerable attention as promising emissive materials for next-generation displays owing to their ability to enable wide color gamut and high luminous efficiency. Owing to quantum confinement effects, nanometer-sized QDs exhibit excellent optical and electrical properties and narrow emission spectra. In electroluminescent quantum dot (EL-QD) displays, each RGB subpixel consists of an individual EL-QD device, enabling a simplified display architecture. Furthermore, QDs capped with appropriate surface ligands can be dispersed in various solvents to form printable inks. These inks are compatible with solution processes such as inkjet printing and coating under ambient conditions, eliminating the need for expensive vacuum equipment. Consequently, the manufacturing process can be readily scaled to larger mother-glass sizes, offering the potential for significant cost reduction.

Driven by these advantages, EL-QD displays have emerged as one of the most promising candidates for next-generation display technologies. However, most high-performance QDs reported to date contain cadmium, which poses environmental and regulatory concerns due to its toxicity. To address this issue, we have developed cadmium-free QD materials and applied them to EL-QD displays.

In this work, we demonstrate two all-inkjet-printed cadmium-free EL-QD displays: an 18.2-inch, 202-ppi display and a 6.55-inch, 264-ppi display. High-performance blue EL-QD devices were realized by integrating ZnSeTe QDs with optimized surface passivation, additive-assisted interparticle spacers, and a robust inkjet-printing process. As a result, the devices exhibited significantly improved external quantum efficiency and extended operational lifetime, demonstrating the feasibility of scalable cadmium-free EL-QD displays fabricated entirely by solution processing.

Keywords

Quantum Dot Light-emitting Diodes, Cadmium-Free, Ink Formulation, Top Emission, Inkjet Printing.