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## Solution-Processed Quantum-Dots Light-Emitting Diodes with PVK/PANI:PSS/PEDOT:PSS Hole Transport Layers

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We report the enhanced performance of poly(N-vinylcarbazole) (PVK)/poly(3,4-ethylenedioxythiophene) polystyrene sulfonate (PEDOT:PSS)-based quantum-dot light-emitting diodes by inserting the polyaniline:poly(p-styrenesulfonic acid) (PANI:PSS) interlayer. The QD-LED with PANI:PSS interlayer exhibited a higher luminance and luminous current efficiency than that without PANI:PSS. Ultraviolet photoelectron spectroscopy results exhibited different electronic energy alignments of QD-LEDs with/without the PANI:PSS interlayer. By inserting the PANI:PSS interlayer, the hole-injection barrier at the QD layer/PVK interface was reduced from 1.45 to 1.23 eV via the energy level down-shift of the PVK layer. The reduced barrier height alleviated the interface carrier charging responsible for the deterioration of the current and luminance efficiency. This suggests that the insertion of PANI:PSS interlayer in QD-LEDs contributed to (i) increase the p-type conductivity and (ii) reduce the hole barrier height of QDs/PVK, which are critical factors leading to improve the efficiency of QD-LEDs.

**Keywords:** Charge balance, Electronic energy level alignment, Hole transport layer, PANI:PSS, Quantum dot light-emitting device