and the promoted hole transport across the multiple quantum wells. The PN-type quantum barrier is favorable for the more homogenous distribution of holes and radiative recombination rates across the whole active region in the proposed device, yielding a better LED performance. In addition, the increased effective conduction band barrier height in the proposed PN-type quantum barriers further suppresses the electron overflow, which further improves the LED performance. As a result, the proposed PN-type quantum barriers theoretically and experimentally prove to be very promising for high-performance LEDs.

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