Electronic Supporting Information

Combined Optimization of Emission layer Morphology and Hole-Transport Layer for Enhanced Performance of Perovskite Light-Emitting Diodes

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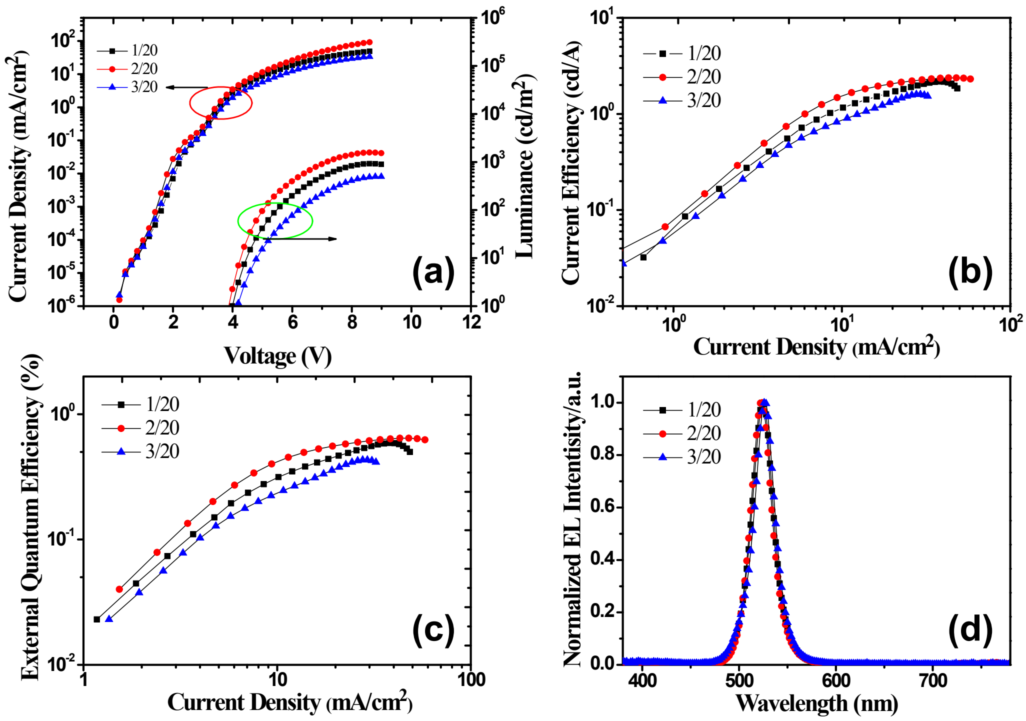

Fig. S1 (a) Current density and luminance *vs* voltage (J–L–V), (b) current efficiency *vs* current density (CE–J), (c) external quantum efficiency *vs* current density (EQE–J) characteristics, and (d) normalized EL spectra (10 mA cm^{-2}) of the PeLEDs with blend films of PVK: $MAPbBr_3$ [x:20, (x= 0, 1, 2, 3)] as the emission layer.

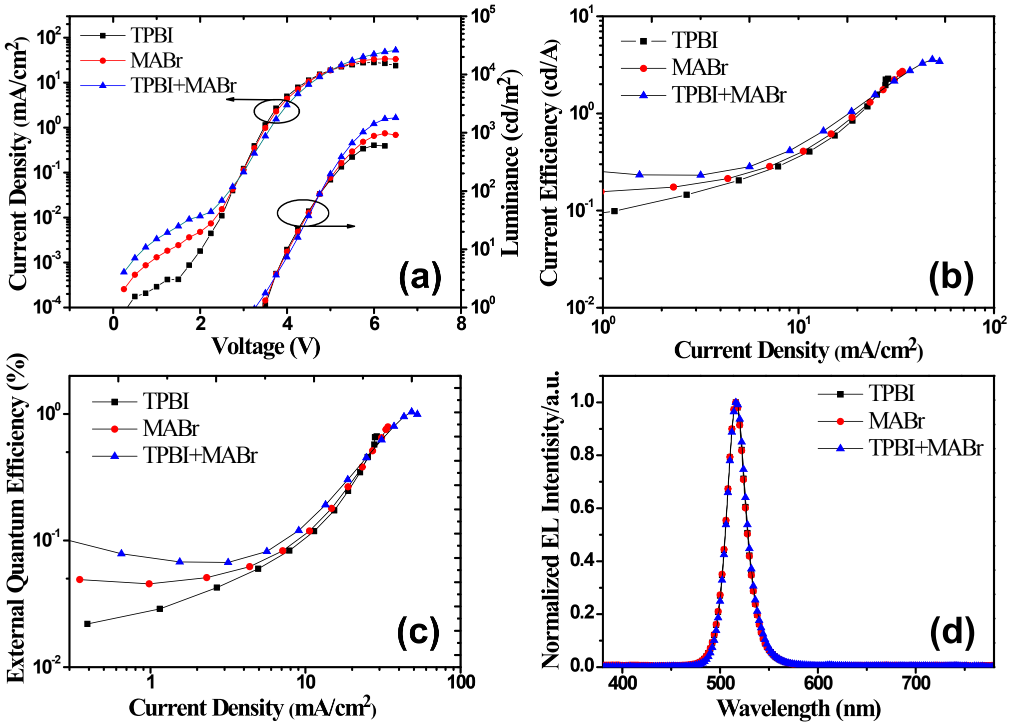

Fig. S2 (a) Current density and luminance *vs* voltage (J–L–V), (b) current efficiency *vs* current density (CE–J), (c) external quantum efficiency *vs* current density (EQE–J) characteristics, and (d) normalized EL spectra of the PeLEDs based on crystal modification with blend films of PVK: $MAPbBr_3$ (w/w, 2:20) as the emission layer.

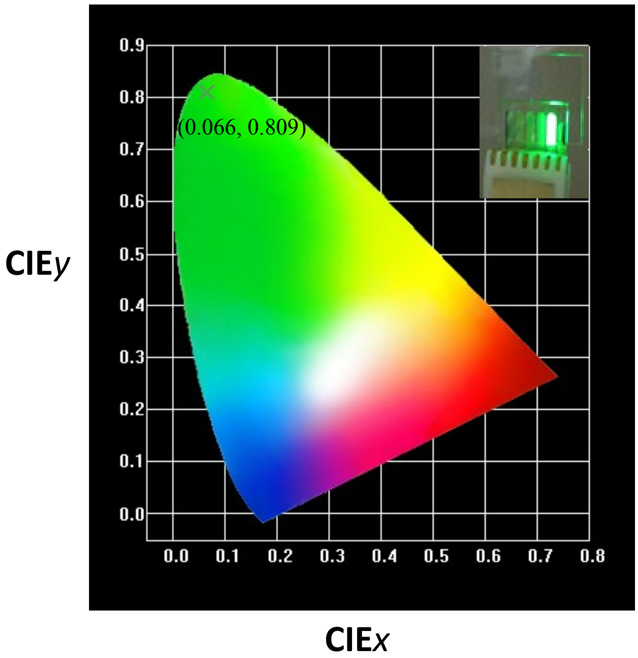

Fig. S3 CIE coordinates for the EL spectrum under a current density of 10 mA cm^{-2}, together with the photograph of the working device as an insert.

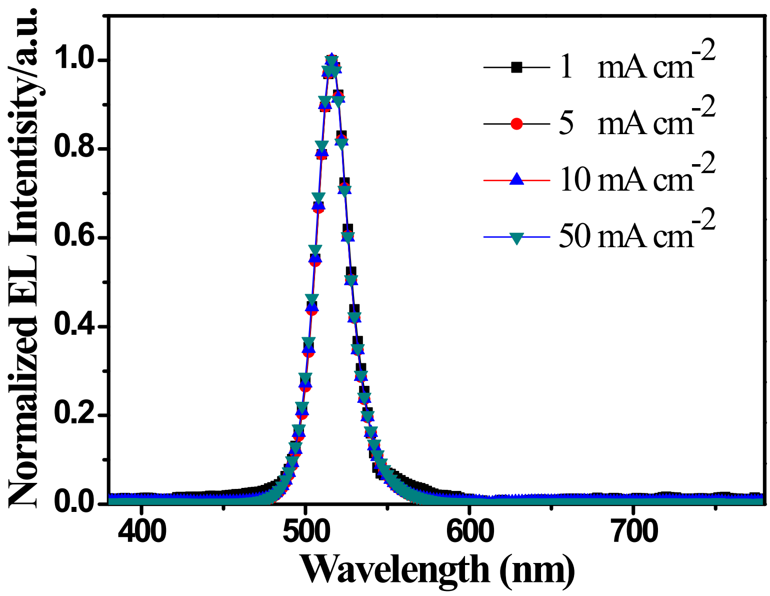

Fig. S4 EL spectra of the device-I under different current densities.

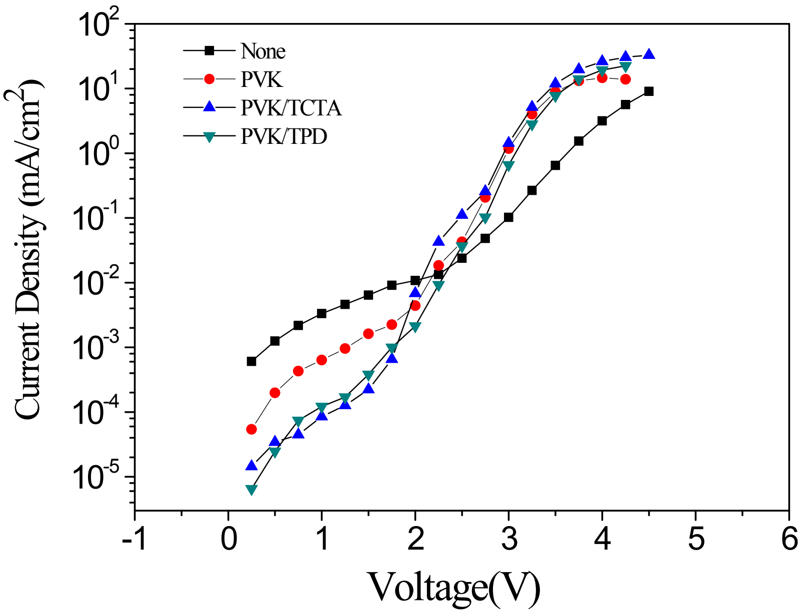

Fig. S5 Effect of the HTLs on the current density *vs* voltage (J–V) characteristics for the PeLEDs with PVK: $MAPbBr_3$ (w/w, 2:20) after crystal modification (MABr+TPBI) as the emission layer.

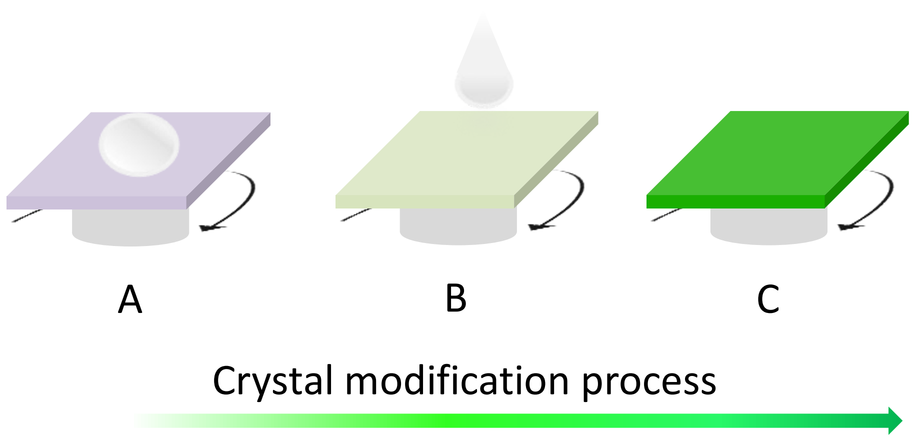

Fig. S6 Schematic illustration of crystal modification process for manufacturing perovskite thin films. (A) Dropped the PVK:$MAPbBr_3$ (w/w, 2:20) precursor solution on the surface of PEDOT:PSS or HTLs, then spin-coated with a certain revolving speed for 60 s; (B) After 6 s during the spin-coating, 30 μL crystal growth modifier was dropped to the film; (C) Then a ~30 nm thin blend film of emitters was got without annealing.