Electronic Supplementary Information (ESI)

Table S1 Device performances of QLEDs w/o a PVK (in o-Xy or 1,4-dioxane) layer

Device	V_{on}[a] (V)	L_{max}[b] (cd m^{-2})	CE_{max}[c] (cd A^{-1})	PE_{max}[d] (lm W^{-1})	EQE_{max}[e] (%)
PVK free	2.2	63259	9.4	9.6	6.5
PVK (o-Xy)	2.0	121667	11.0	8.0	7.4
PVK (1,4-dioxane)	2.0	142748	13.7	11.7	9.2

[a] The voltage at a luminance reaching 1 cd m^{-2}; [b] maximum luminance; [c] maximum current density; [e] maximum external quantum efficiency

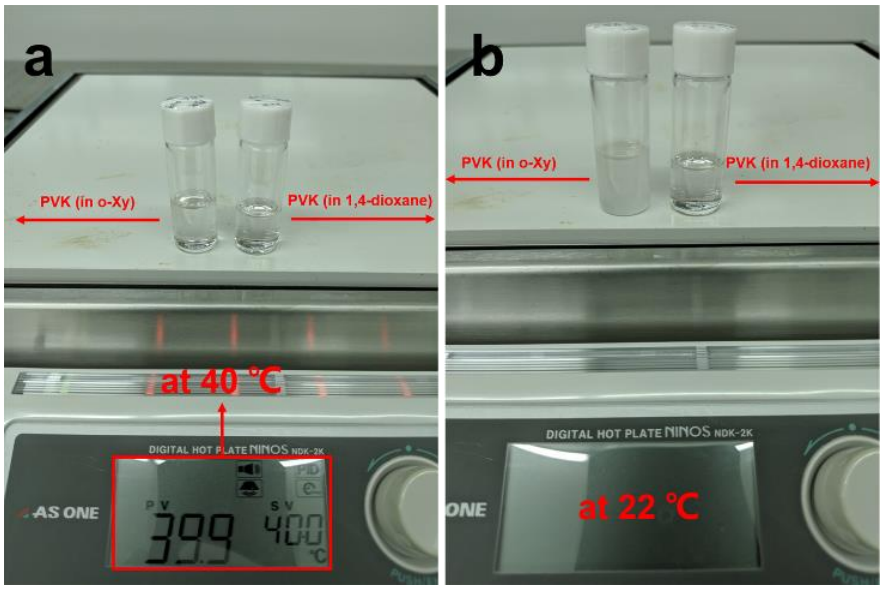

Fig. S1 Images of PVK (in *o*-xylene or 1,4-dioxane) solution on a hot plate. (a) The hot plate is in running state and the temperature is set to 40 ℃. (b) The hot plate is switched off and the temperature is 22 ℃.

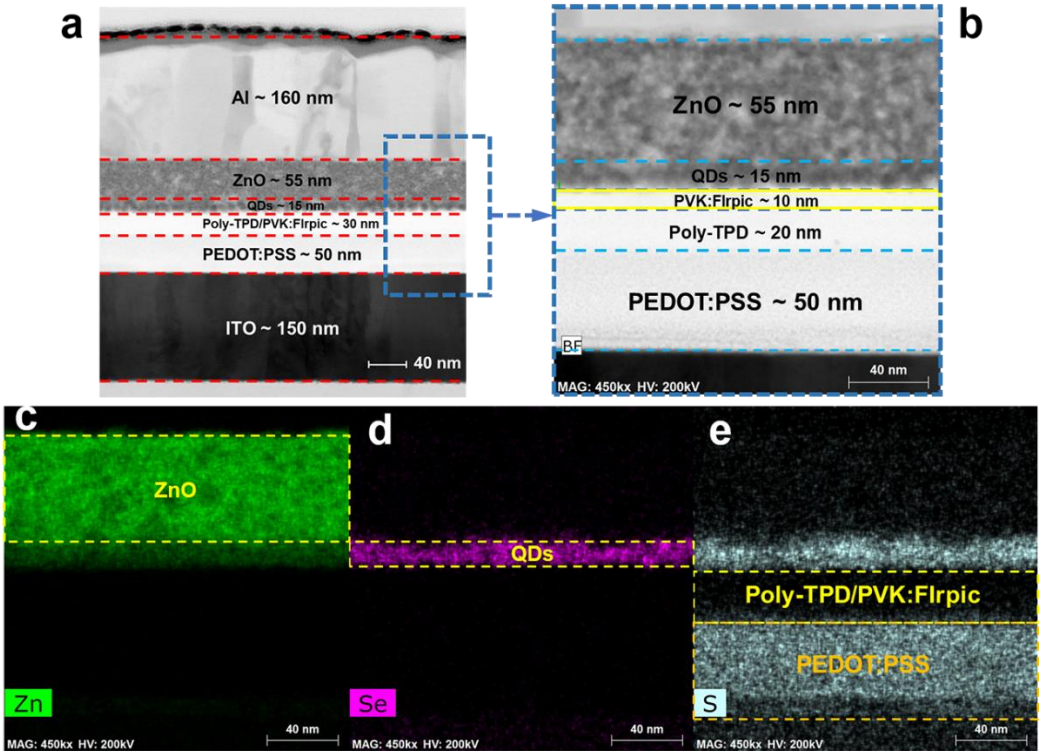

Fig. S2 (a) Cross-sectional high-resolution STEM image of co-HTL QLED with PVK:FIrpic (10:2). (b) The enlarged image of the blue frame in Fig. S2(a). (d–e) EDS compositional mapping images of various elements in QLED.

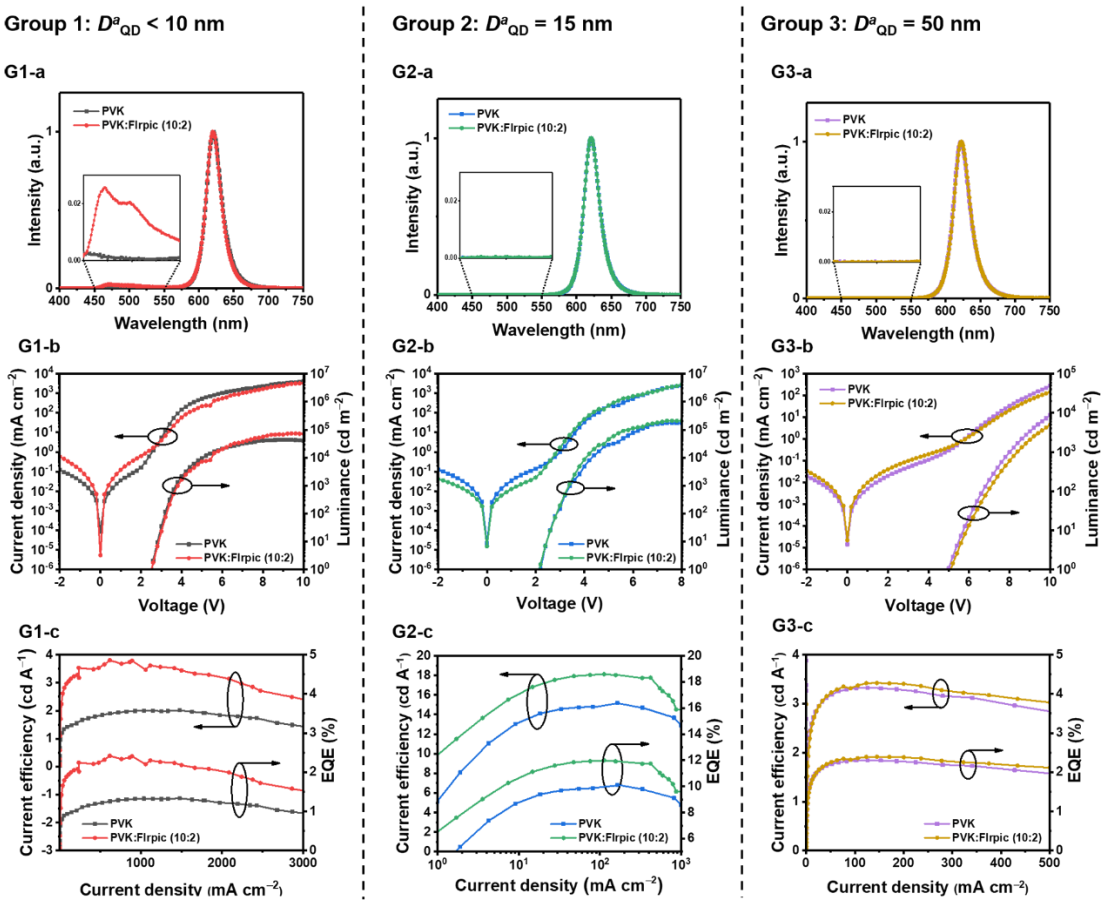

Fig. S3 (a) Normalized EL spectra. The insets show the enlarged EL spectra from 450 to 550 nm. (b) *J*-*V*-*L*, and (c) CE-*J*-EQE characteristics of three sets of co-HTL QLEDs with PVK and PVK:FIrpic (10:2). [a] The QD thicknesses are less than 10 nm for Group 1, 15 nm for Group 2 and 50 nm for Group 3, respectively.

Table S2 Device performances of three sets of co-HTL QLEDs with PVK and PVK:FIrpic (10:2)

Group	Device	Turn-on voltage (V)	CE_{max} (cd A^{-1})	PE_{max} (lm W^{-1})	EQE_{max} (%)	EQE_{max} enhancement (%)
1	PVK	2.4	2.01	1.19	1.34	80.6
	PVK:FIrpic (10:2)	2.4	3.80	2.22	2.42	
2	PVK	2.2	15.19	11.66	10.11	18.6
	PVK:FIrpic (10:2)	2.2	18.13	14.51	11.99	
3	PVK	5.0	3.32	1.20	2.30	3.9
	PVK:FIrpic (10:2)	5.0	3.42	1.15	2.39	

The QD thickness are less than 10 nm for Group 1, 15 nm for Group 2 and 50 nm for Group 3, respectively.

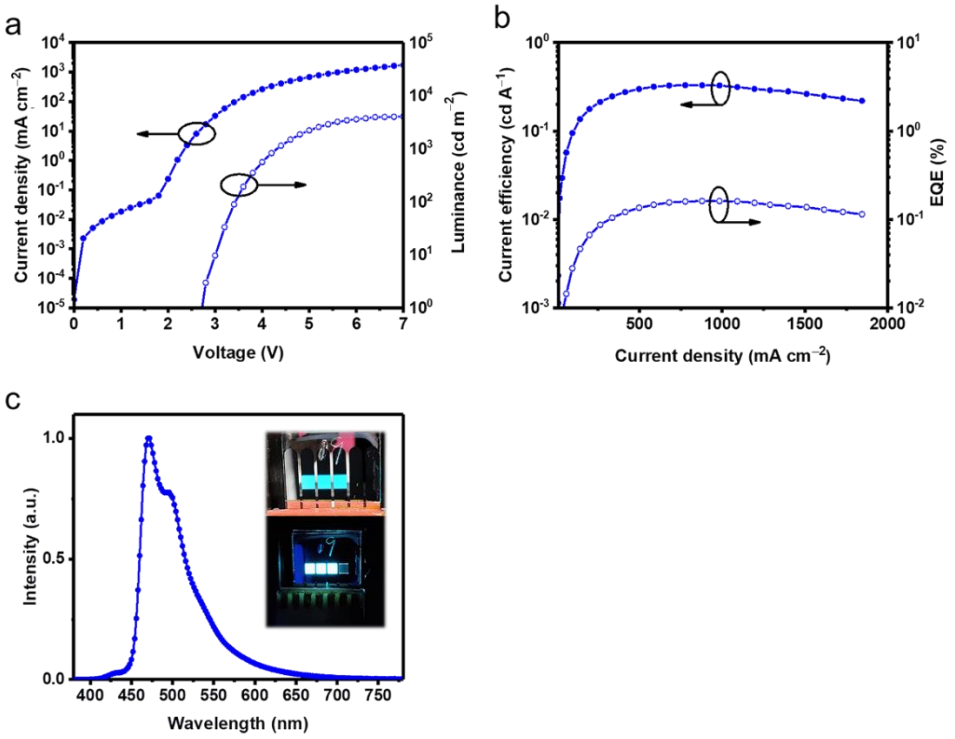

Fig. S4 (a) *J*-*V*-*L*, (b) CE-*J*-EQE characteristics, and (c) Normalized EL spectrum of the blue OLED device with the architecture of ITO/PEDOT:PSS/poly-TPD/PVK:FIrpic (10:2)/ZnO/Al without QDs (Insets: images at 50 mA cm^{-2}).

Table S3 Average PL lifetimes at 471 nm (FIrpic emission) of the samples

Sample	τ_1 (μs)	A_1	τ_2 (μs)	A_2	τ_{av}[a] (μs)
Quartz/PVK:FIrpic (10:1)	0.24	286	0.91	640	0.84
Quartz/PVK:FIrpic (10:2)	0.28	313	0.94	652	0.86
Quartz/PVK:FIrpic (10:2)	0.16	345	0.74	626	0.68

[a] Average PL lifetime calculated by the formula of $\tau_{av} = (A_1\tau_1^2 + A_2\tau_2^2 + \ldots + A_i\tau_i^2)/(A_1\tau_1 + A_2\tau_2 + \ldots + A_i\tau_i)$