Supporting information

All-exciplex-based white organic light-emitting diodes by employing an interface-free sandwich light-emitting unit achieving high electroluminescence performance

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Section S1

The ITO substrates were cleaned first with acetone, deionized water and acetone, and then dried in drying cabinet, and treated with ultraviolet-ozone for 15 min. After these processes, the cleaned ITO glass substrates were loaded in a vacuum chamber, a base pressure of $\leq 5\times10^{-4}$ Pa, for film deposition using thermal evaporation technology. The deposition rate and film thickness were monitored controlled by the calibrated crystal quartz sensors, e.g., the deposition rates of organic materials, MoO_3, LiF, and cathode Al were controlled at about 1 Å/s, 0.3 Å/s, 0.1 Å/s, and 3−6 Å/s, respectively. Organic films for PL measurements were fabricated with the same method as device fabrication. The EL spectra and CIE coordinates of all OLEDs were measured by a computer controlled PR-655 spectra scan spectrometer. The current density-voltage-luminance characteristics, current efficiency, and power efficiency were recorded by a computer-controlled Keithley 2400 source integrated with a BM-70A luminance meter. The EQE was calculated from the current density-voltage-luminance curve and spectra data.

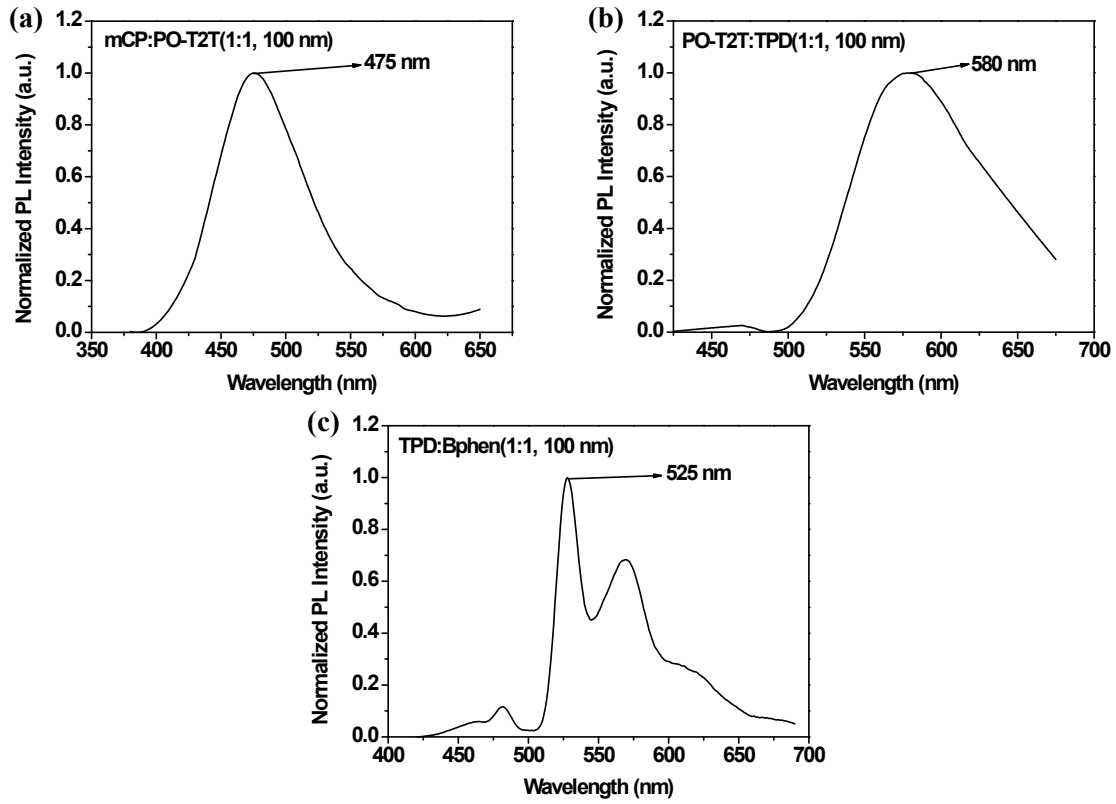

Fig. S1 The normalized phosphorescence spectra for mCP:PO-T2T(1:1, 100 nm), PO-T2T:TPD(1:1, 100 nm), and TPD:Bphen(1:1, 100 nm) films at 77 K.

Table S1 Summary of key parameters for three mCP:PO-T2T-, PO-T2T:TPD- and TPD:Bphen-forming exciplex.

Exciplex	PL peak (nm)	S_1[a] (eV)	T_1[b] (eV)	ΔE_{ST}[c] (eV)	$\tau 1$[d] (ns)	$\tau 2$[e] (ns)	PLQY[f] (%)
mCP:PO-T2T	471	2.63	2.61	0.02	380.00	7380.00	17.76
PO-T2T:TPD	565	2.20	2.14	0.06	8.62	48.20	4.90
TPD:Bphen	462	2.68	2.35	0.33	8.13	36.49	6.18

[a]S_1 is the singlet energy level;

[b]T_1 is the triplet energy level;

[c]ΔE_{ST} is the singlet–triplet energy splitting;

[d]$\tau 1$ is the prompt lifetime;

[e]$\tau 2$ is the delayed lifetime;

[f]The PLQY of three exciplex are tested by using the integrating sphere method at an atmosphere environment.

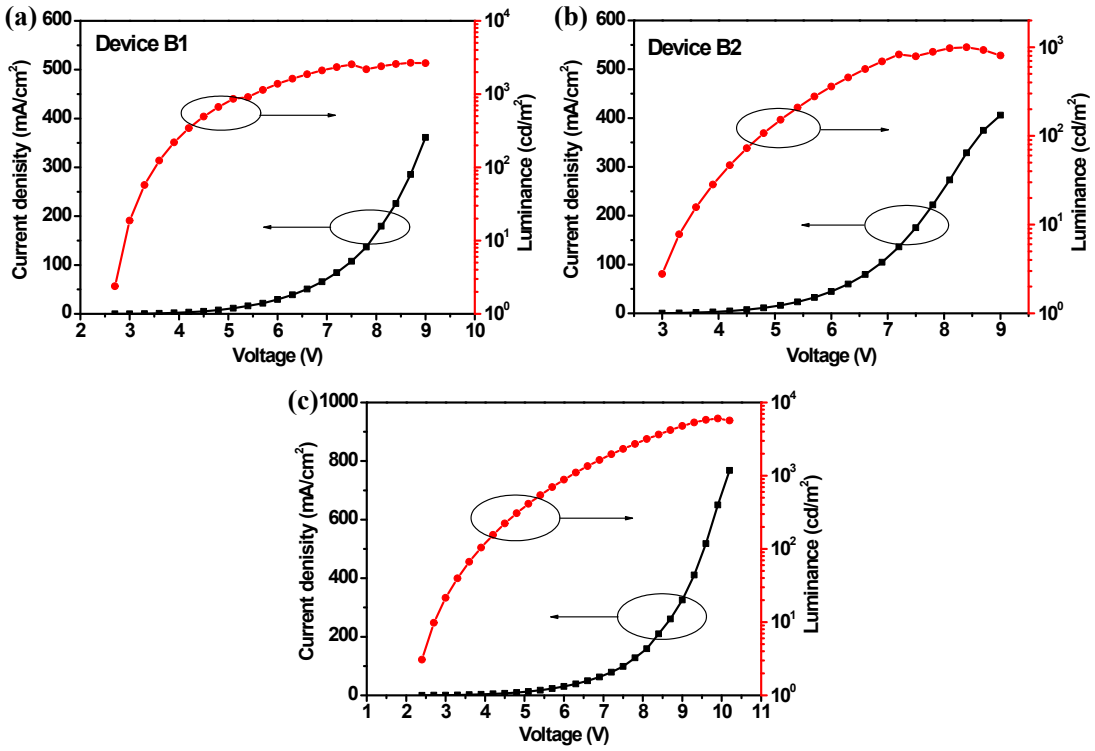

Fig. S2 The current density-voltage-luminance curves for devices B1, B2 and Y.

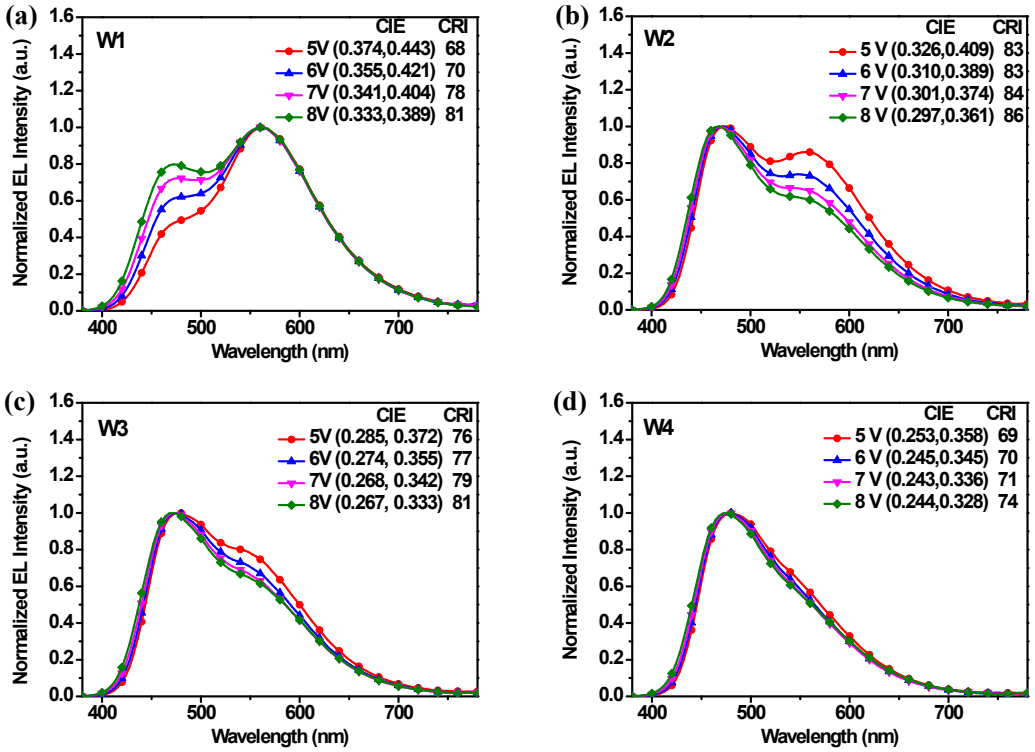

Fig. S3 The normalized EL spectra, CIE coordinates and CRI of four devices W1-W4 at different voltages from 5V to 8V.

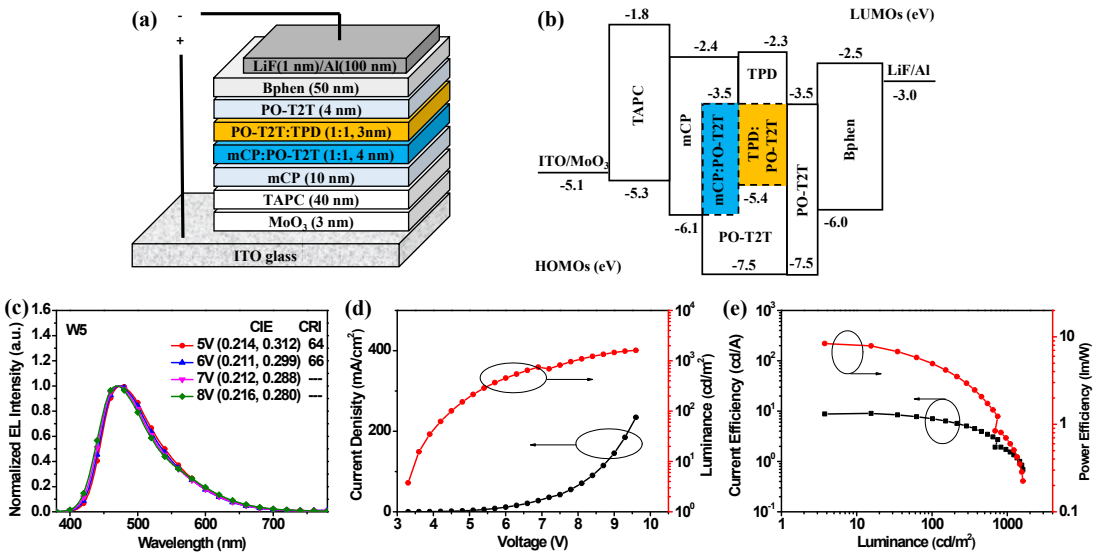

Fig. S4 The device structure (a) and energy levels (b) diagrams for white device W5; The normalized EL spectra, CIE coordinates and CRI under different voltages (c), current density-voltage-luminance curves (d), and current efficiency-luminance-power efficiency curves (e) for the white devices W5.

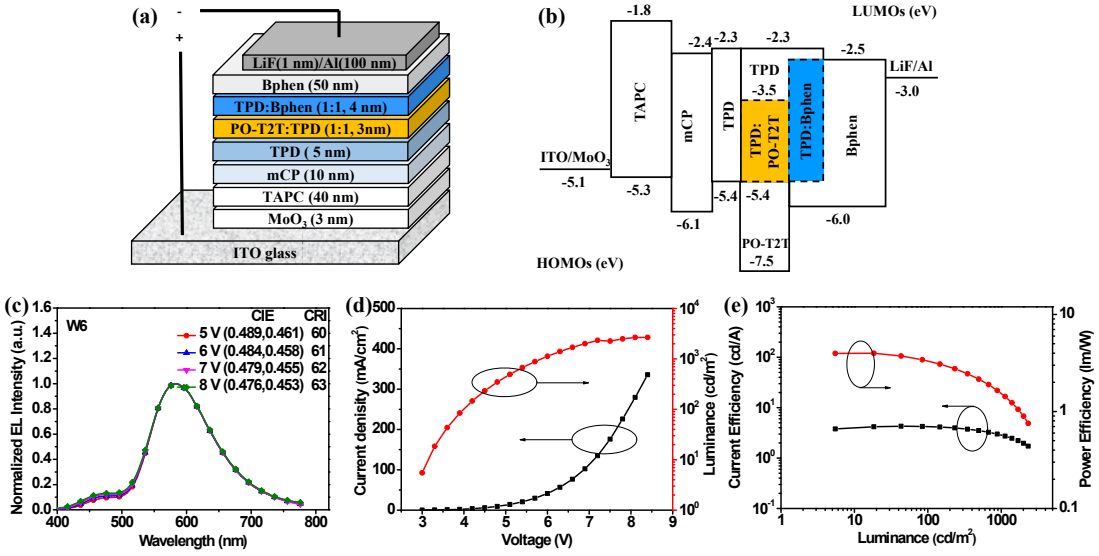

Fig. S5 The device structure (a) and energy levels (b) diagrams for white deviceW6; The normalized EL spectra, CIE coordinates and CRI under different voltages (c), current density-voltage-luminance curves (d), and current efficiency-luminance-power efficiency curves (e) for the white devices W6.