Supporting Information (SI)

Utilization of double-sensitized structure toward achieving high performance green and red phosphorescent organic light-emitting diodes

Shuaibing Li [a,b], Ruixia Wu [a], Kai Chen [a], Weidong Sun [a], Zhenzhen Li [a] and Liang Zhou [a,b,*]

[a] State Key Laboratory of Rare Earth Resource Utilization, Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, Changchun 130022, People's Republic of China

[b] University of Science and Technology of China, Hefei 230027, People's Republic of China

Table S1. The key properties of green single-EML devices with Ir(mppy)$_3$ at different doping concentrations.

Device	$V_{\text{turn-on}}$ (V)	B^a (cd m^{-2})	η_c^b (EQE^c) (cd A^{-1})	η_p^d (lm W^{-1})	η_c^e (cd A^{-1}) (EQE^f) (1000 cdm^{-2})	$CIE_{x,y}{}^g$
6 wt%	2.5	45313	74.99 (23.1%)	78.49	51.64 (15.6%)	(0.267, 0.629)
8 wt%	2.7	43119	76.12 (23.8%)	75.36	44.04 (13.3%)	(0.271, 0.627)
10 wt%	2.6	55458	81.59 (25.1%)	87.94	58.52 (13.8%)	(0.278, 0.624)
12 wt%	2.7	58394	80.78 (24.7%)	84.33	70.01 (21.0%)	(0.281, 0.625)
14 wt%	2.6	59660	77.45 (23.6%)	86.86	69.79 (21.0%)	(0.286, 0.622)
16 wt%	2.6	66268	71.14 (21.5%)	75.50	67.31 (20.2%)	(0.290, 0.621)

[a] The data for maximum brightness (B), [b] maximum current efficiency (η_c), [c] maximum external quantum efficiency (EQE), [d] maximum power efficiency (η_p), [e] current efficiency (η_c) at the practical brightness of 1000 cd m^{-2}, [f] external quantum efficiency (EQE) at the practical brightness of 1000 cd m^{-2}, [g] Commission Internationale de l'Eclairage coordinates ($CIE_{x,y}$) at 10 mA cm^{-2}.

Figure S1 (a) EL efficiency-current density (η-J) characteristics of green single-EML devices with Ir(mppy)$_3$ at different doping concentrations. Inset: Current density-brightness-voltage (J-B-V) characteristics of green single-EML devices with Ir(mppy)$_3$ at different doping concentrations. **(b)** Normalized EL spectra of green single-EML devices with Ir(mppy)$_3$ at different doping concentrations operating at 10 mA cm^{-2}.
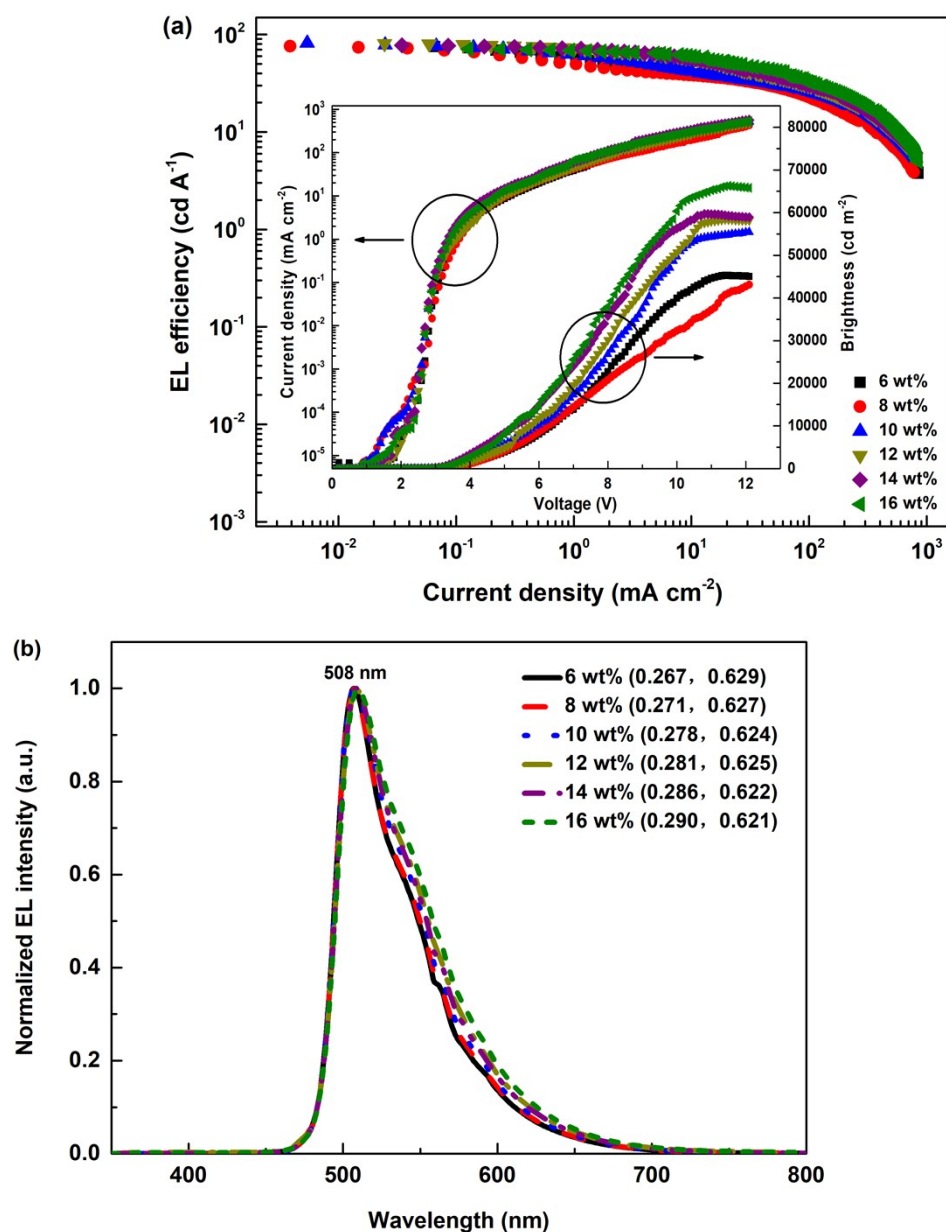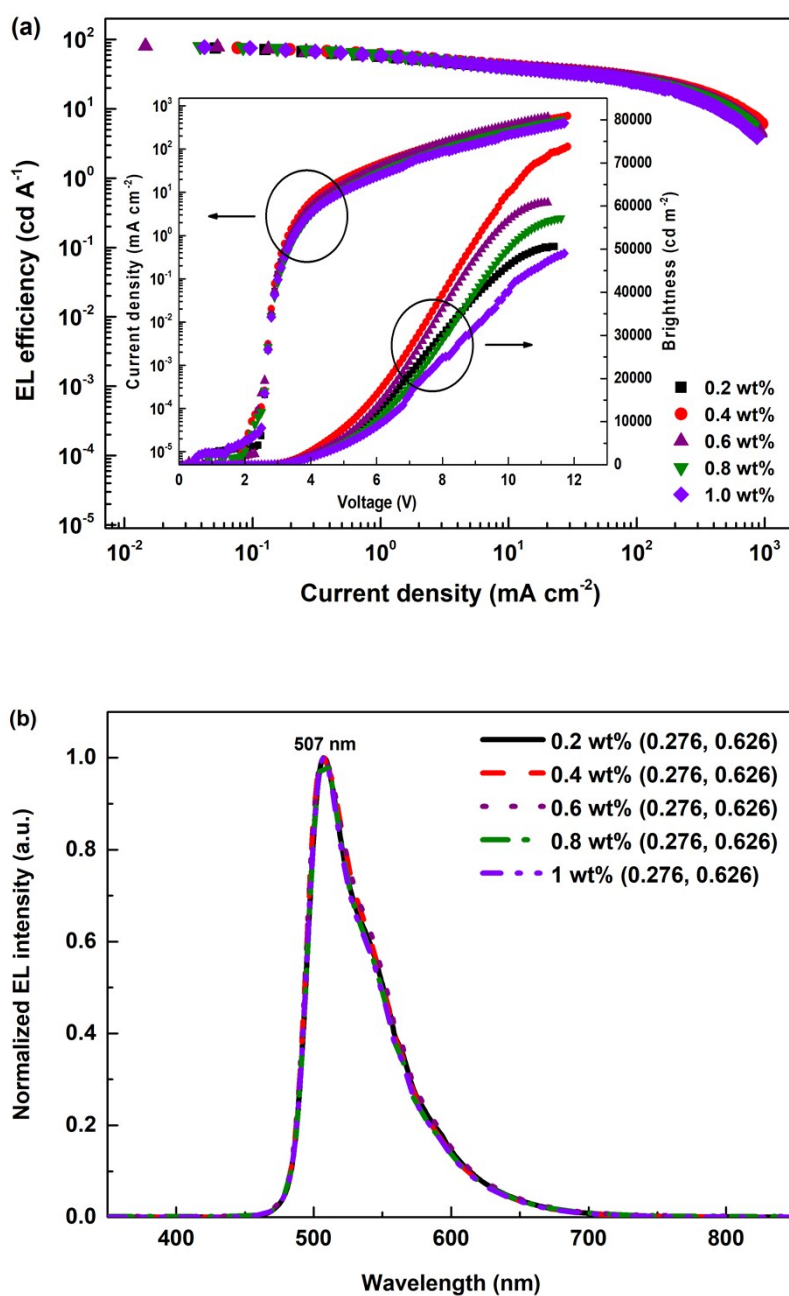
Table S2. The key properties of green single-EML devices with FK306 at different co-doping concentrations in EML.

Device	$V_{\text{turn-on}}$	B^a	η_c^b (EQE^c)	η_p^d	η_c^e (cd A^{-1}) (EQE^f)	CIE$_{x,y}^g$
	(V)	(cd m^{-2})	(cd A^{-1})	(lm W^{-1})	(1000 cd m^{-2})	
0.2 wt%	2.7	50626	74.64 (23.1%)	74.42	51.67 (15.5%)	(0.276, 0.626)
0.4wt%	2.6	73787	75.21 (22.9%)	74.69	55.38 (16.7%)	(0.269, 0.628)
0.6 wt%	2.7	60783	80.65 (24.7%)	76.49	51.55 (15.5%)	(0.275, 0.625)
0.8 wt%	2.5	57155	78.87 (23.8%)	79.82	54.41 (16.4%)	(0.272, 0.627)
1 wt%	2.7	49014	77.56 (24.1%)	70.92	53.43 (16.1%)	(0.271, 0.627)

[a] The data for maximum brightness (B), [b] maximum current efficiency (η_c), [c] maximum external quantum efficiency (EQE), [d] maximum power efficiency (η_p), [e] current efficiency (η_c) at the practical brightness of 1000 cd m^{-2}, [f] external quantum efficiency (EQE) at the practical brightness of 1000 cd m^{-2}, [g] Commission Internationale de l'Eclairage coordinates (CIE$_{x,y}$) at 10 mA cm^{-2}.

Fig. S2 (a) EL efficiency-current density (*η-J*) characteristics of green single-EML devices with FK306 at different co-doping concentrations in EML. Inset: Current density-brightness-voltage (*J-B-V*) characteristics of green single-EML devices with FK306 at different co-doping concentrations in EML. **(b)** Normalized EL spectra of green single-EML devices with FK306 at different co-doping concentrations in EML operating at 10 mA cm^{-2}.

Table S3. The key properties of green single-EML sensitized devices with FK306 at different doping concentrations in ETL.

| Device	$V_{turn-on}$ (V)	B^a (cd m^{-2})	η_c^b (EQE^c) (cd A^{-1})	η_p^d (lm W^{-1})	η_c^e (cd A^{-1}) (EQE^f) (1000 cd m^{-2})	$CIE_{x,y}^g$
0.8 wt%	2.7	56351	76.90 (23.7%)	79.51	59.68 (18.0%)	(0.269, 0.628)
1 wt%	2.5	67862	78.29 (23.9%)	80.81	60.34 (18.2%)	(0.277, 0.624)
2 wt%	2.5	70215	86.67 (26.2%)	87.50	68.02 (20.5%)	(0.272, 0.628)
3 wt%	2.5	62850	79.65 (24.3%)	74.29	63.52 (19.1%)	(0.277, 0.624)
4 wt%	2.7	59753	76.44 (23.5%)	80.67	62.55 (18.9%)	(0.275, 0.625)
5 wt%	2.7	49652	74.65 (23.0%)	72.31	57.86(17.4%)	(0.268, 0.627)

[a] The data for maximum brightness (B), [b] maximum current efficiency (η_c), [c] maximum external quantum efficiency (EQE), [d] maximum power efficiency (η_p), [e] current efficiency (η_c) at the practical brightness of 1000 cd m^{-2}, [f] external quantum efficiency (EQE) at the practical brightness of 1000 cd m^{-2}, [g] Commission Internationale de l'Eclairage coordinates ($CIE_{x,y}$) at 10 mA cm^{-2}.

Fig. S3 (a) EL efficiency-current density (*η-J*) characteristics of green single-EML sensitized devices with FK306 at different doping concentrations in ETL. Inset: Current density-brightness-voltage (*J-B-V*) characteristics of green single-EML sensitized devices with FK306 at different doping concentrations in ETL. **(b)** Normalized EL spectra of green single-EML sensitized devices with FK306 at different doping concentrations in ETL operating at 10 mA cm^{-2}.
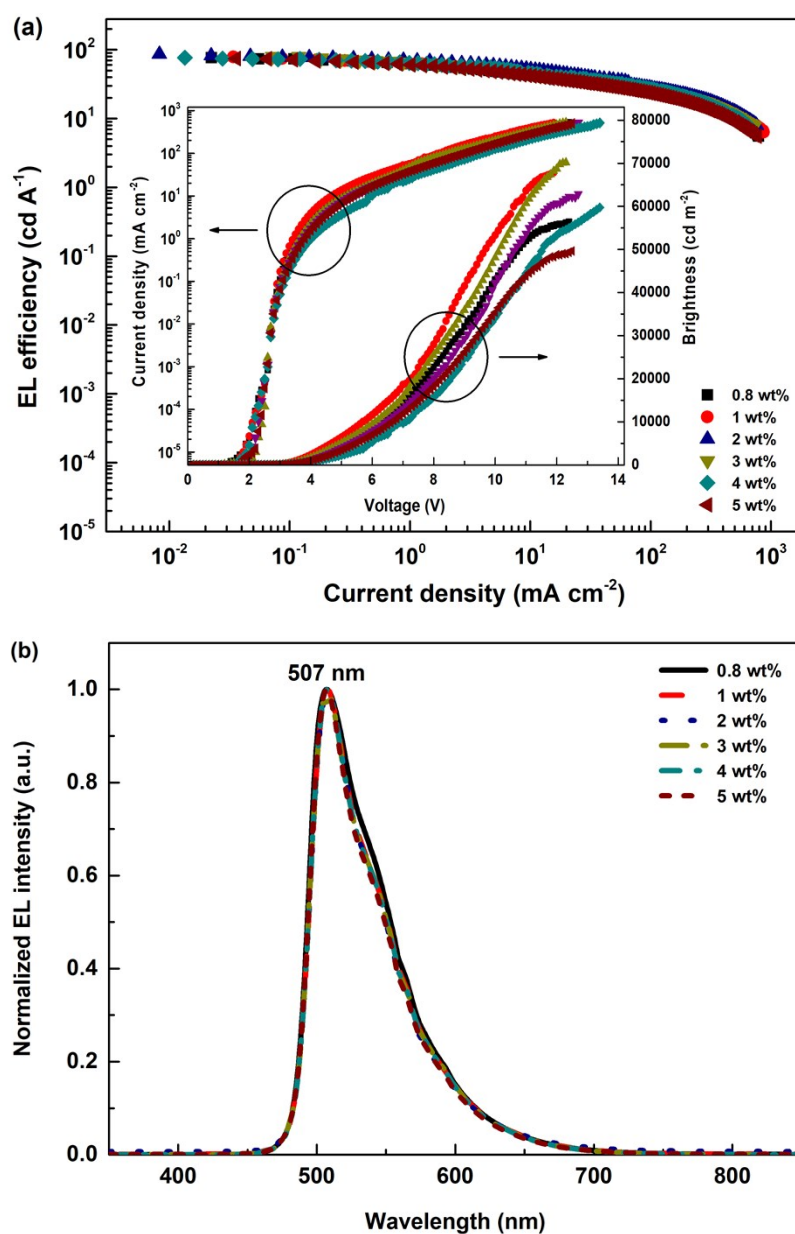
Figure S4 Proposed energy levels diagram of the designed red OLEDs in this work and the molecular structure of Ir(piq)$_3$.
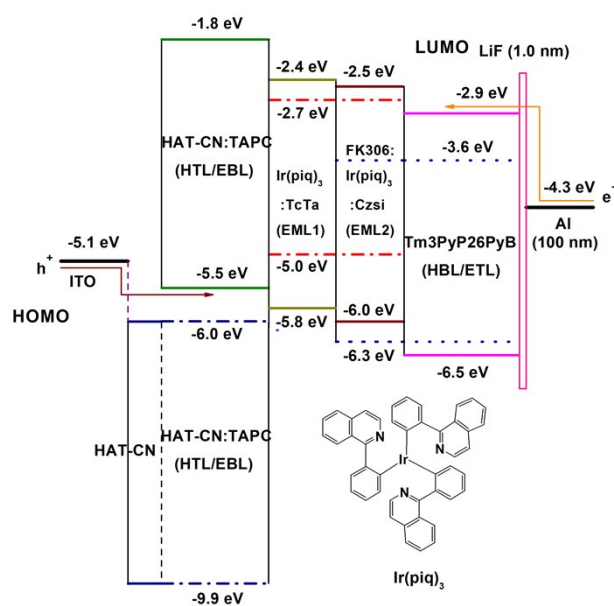
Fig. S5. Transient EL decay curves of device A and C.