Supporting Information

Efficient Organic Light Emitting Diode through Triplet Exciton Reharvesting by Employing Blended Electron Donor and Acceptor as the Emissive Layer

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EXPERIMENTAL DETAILS

OLED devices were fabricated by vacuum thermal evaporation under the base pressure ~ 4×10^{-6} Torr. Prior to deposition of the organic layers, the commercial 100-nm-thick tin-doped indium oxide (ITO) substrates were cleaned with the diluted detergent and distilled water under ultrasonic bath and then treated by oxygen and CF4 plasma. After the fabrication, the devices were immediately encapsulated with glass lid and getter attached under nitrogen atmosphere using UV-epoxy resin. The active area of the OLED device is 10.89 mm^2. The luminance, EL spectrum and current density versus voltage (J-V) characteristics of the OLED device were measured using Spectrascan 650 spectrometer connected with Keithley 236 source measure unit under room temperature. The EQE was calculated from spectral luminance intensity in the forward angle direction of the OLED device with a Lambertian-pattern assumption.

The PL spectra were measured by exciting the sample with a 325 nm He-Cd laser. Sample emission was directed into a monochromator (SpectraPro 500i). The absorption spectra were measured by HP 8453 UV-visible spectrophotometer. The time-resolved PL was obtained using an oscilloscope (Agilent Infiniium), excited with a pulsed 337 nm N_2 laser. Time-delayed PL spectra were obtained by exciting the sample with a pulsed, 355 nm Nd:YAG laser. A Model SR250 Gated Integrator and Boxcar Averager Module was used to provide a delay time from 1 ns to 10 ms and the gate width is continuously adjustable from 1 ns to 15 μs. Different ambient temperatures of the sample were realized using EDWARDS Cryodrive 3.0 connected with Intelligent Temperature Controller.

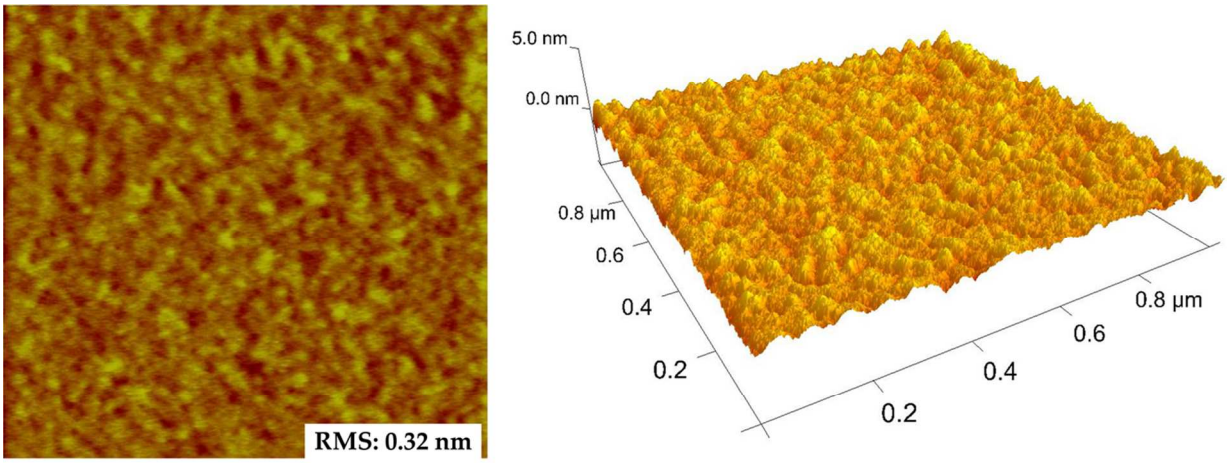

Figure S1. Atomic force microscopy (AFM) image of 30-nm thick mixed TCTA:Tm3PyBPZ (1:1) film.

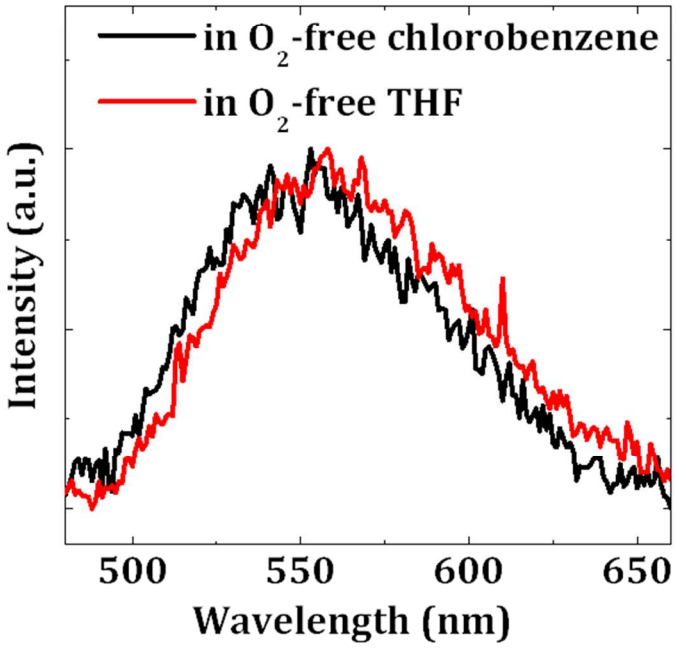

Figure S2. The PL spectra of TCTA:Tm3PyBPZ in oxygen-free chlorobenzene and in oxygen-free tetrahydrofuran (THF).

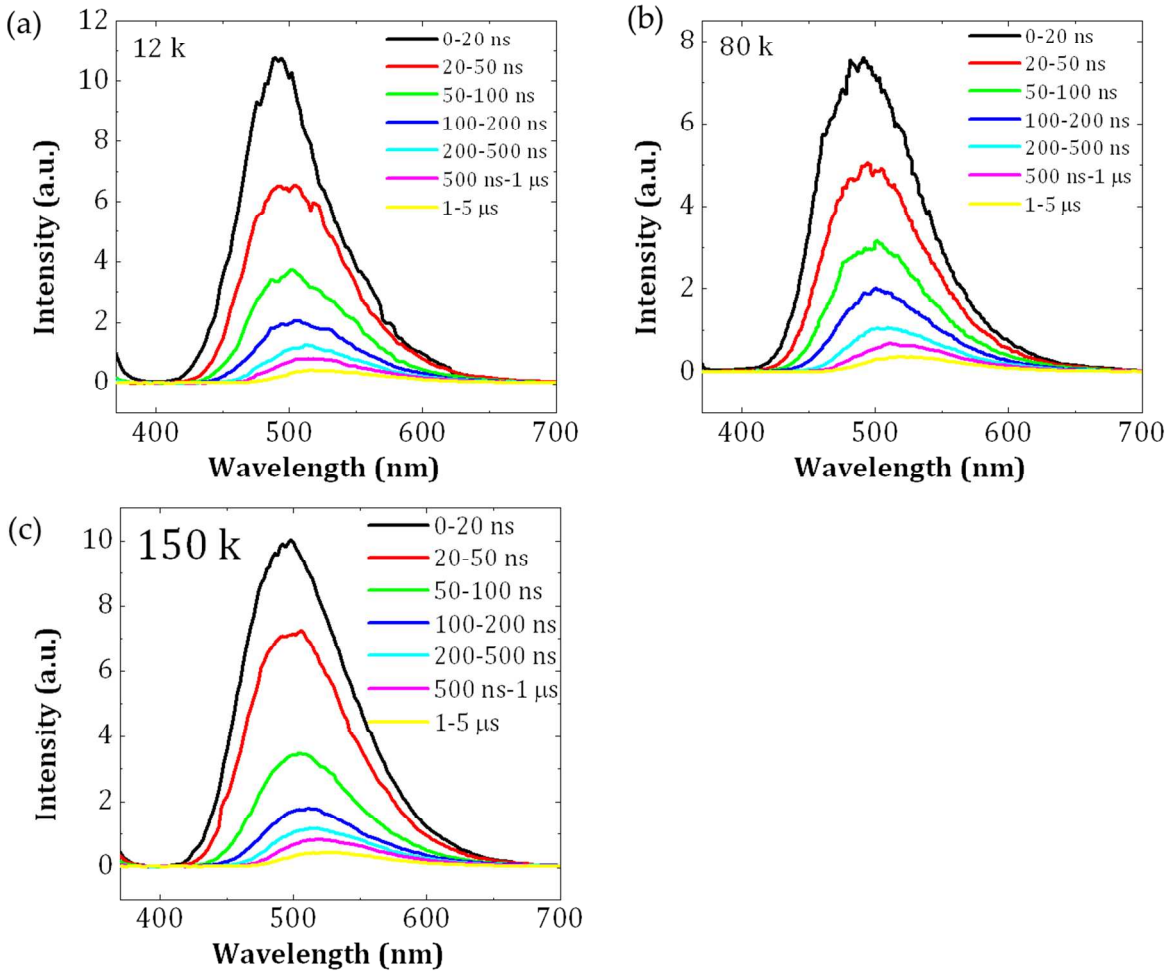

Figure S3. The time-delayed PL spectra of TCTA:Tm3PyBPZ (1:1) film under 355 nm excitation. (a) The time-delayed PL spectra at 12 K. (b) The time-delayed PL spectra at 80 K. (c) The time-delayed PL spectra at 150 K.

Table S1. Summary of A_1, A_2, τ_1 and τ_2 estimated from the time-resolved PL of TCTA:Tm3PyBPZ (1:1) film under different temperatures.

Temperature (K)	τ_1 (ns)	A_1 (%)	τ_2 (μs)	A_2 (%)
12	48.8	90.2	2.9	9.8
80	78.4	86.4	4.6	13.6
150	73.8	82.3	3.8	17.8
300	53.7	74.8	2.3	25.2

Table S2. Luminance (L), current efficiencies (CE), power efficiencies (PE) and external quantum efficiencies (EQE) of the OLED devices.

Device	Maximum				at 100 cd/m^2			at 1000 cd/m^2		
	L [cd/m^2]	CE [cd/A]	PE [lm/W]	EQE [%]	CE [cd/A]	PE [lm/W]	EQE [%]	CE [cd/A]	PE [lm/W]	EQE [%]
A	7606	30.6	40.1	9.2	24.6	27.6	7.4	14.4	11.9	4.3
B	12800	44.2	54.5	13.1	39.6	44.5	11.8	29.5	25.8	8.8
C	10420	28.7	32.2	8.7	20.9	20.5	6.3	18.7	15.4	5.7