Supporting Information

An unprecedented spike of the electroluminescence turn-on transient from guest-doped OLEDs with strong electron-donating abilities of host carbazole groups

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Supporting Figures

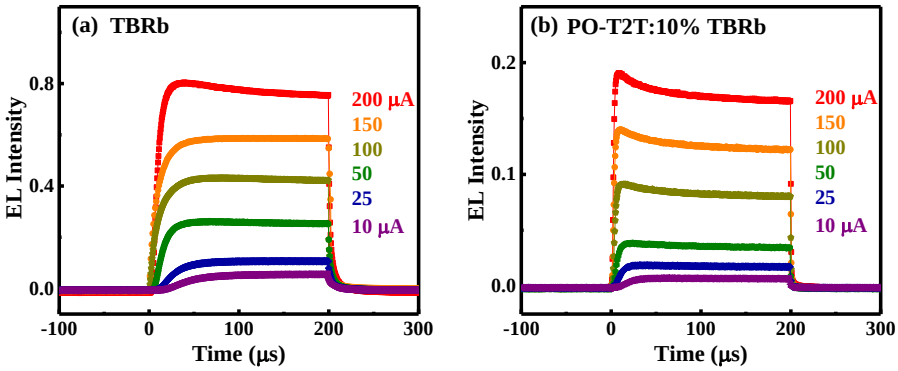

Figure S1. TEL waveforms of an OLED with the TBRb pure film (a) and PO-T2T:10%TBRb (b) as the luminescent layer, respectively.

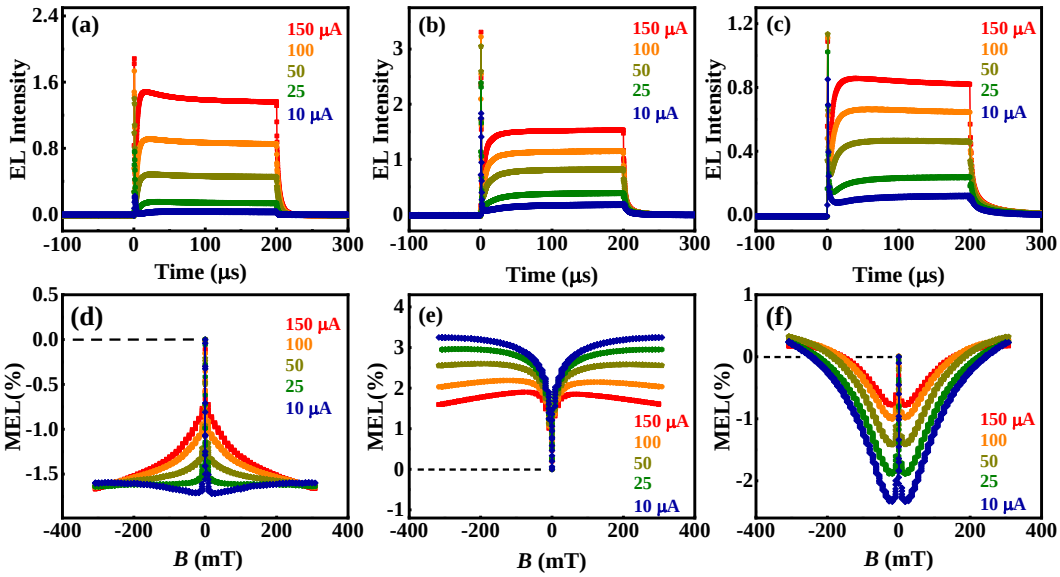

Figure S2. (a-c) Complete TEL profiles from bias pulse on to off for TBRb-doped OLEDs applied with different pulsed currents. (d-f) Room-temperature current-dependent MEL

responses from three different devices.

(a, d) ITO/PEDOT:PSS/*m*-MTDATA/TCTA:10%TBRb/Bphen/LiF/Al.

(b, e) ITO/PEDOT:PSS/*m*-MTDATA/TCTA:10%TBRb/Alq_3/LiF/Al.

(c, f) ITO/PEDOT:PSS/*m*MTDATA/mCP:10%TBRb/Bphen/LiF/Al.

Table S1. The curve colors corresponding to the different operating temperatures for measuring the device TEL curves shwon in Figure 2 and Figure S3.

Curves	Temperature	Curves	Temperature
	300 K		100 K
	250 K		75 K
	200 K		50 K
	150 K		25 K
	125 K		10 K

Table S2. The spike or 'spikes' transition temperatures for different devices studied.

Device structures	Spike ending temperature	'Spikes' emergence temperature (rising edge)	'Spikes' emergence temperature (falling edge)
TCTA:10%TBTb	125 K	125 K	150 K
CBP:10%TBTb	125 K	125 K	125 K
mCP:10%TBTb	125 K	125 K	150 K
PO-T2T:10%TBTb	No Spike	75 K	125 K
Alq_3:10%TBTb	No Spike	75 K	100 K
Bphen:10%TBTb	No Spike	75 K	100 K
m-MTDATA:10%TBTb	No Spike	150 K	125 K
TAPC:10%TBTb	No Spike	100 K	75 K
NPB:10%TBTb	No Spike	150 K	75 K

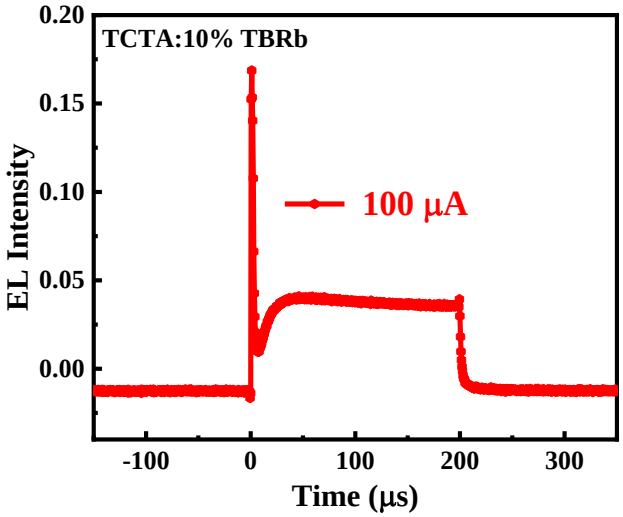

Figure S3. The TEL waveform from the device structure of ITO/PEDOT:PSS/*m*-MTDATA (60 nm)/TCTA:10%TBRb(40 nm)/Bphen(60 nm)/LiF(1 nm)/Al(100 nm) using a high pass filter of 450 nm wavelength.

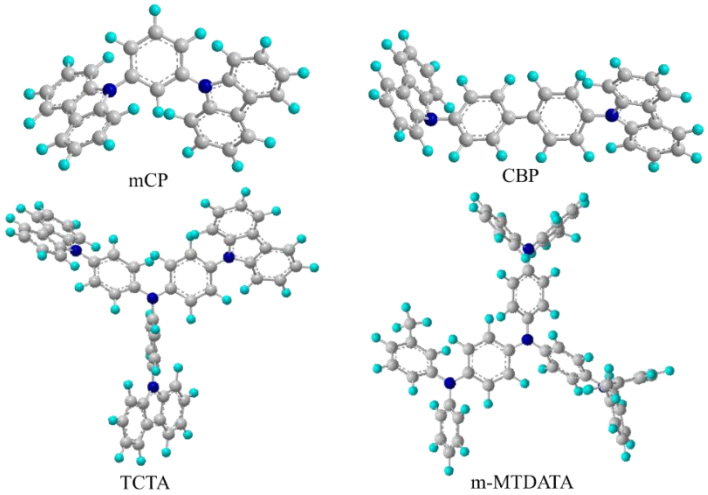

Figure S4. The molecular spatial structures of four host materials (mCP, CBP, TCTA and *m*-MTDATA). One nitrogen atom and two benzene rings form a pentagonal structure and two benzene rings form carbazole.

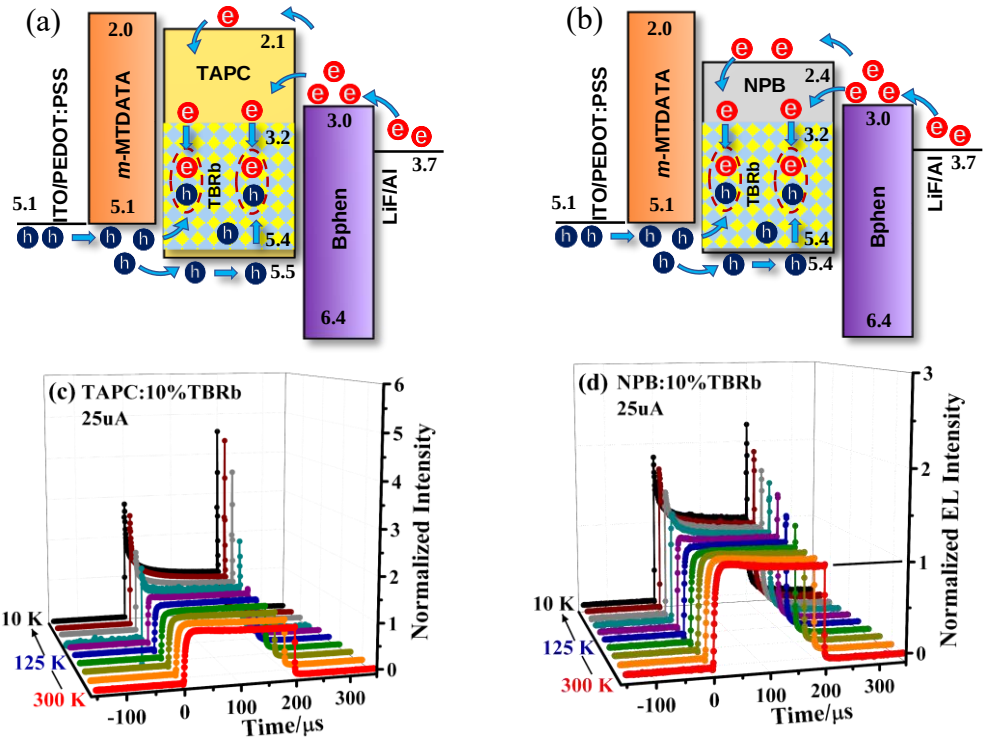

Figure S5. (a, b) Schematic diagram of energy level structures and the charge-carrier dynamic processes of TBRb-doped OLEDs with the hosts of TAPC and NPB, respectively. (c, d) Temperature-dependent TEL curves acquired at the pulsed bias current of 25 μA from OLEDs based on various host materials of NPB and TAPC. Here, the devices structures are ITO/PEDOT:PSS/*m*-MTDATA (60 nm)/ host:10%TBRb (40 nm)/Bphen (60 nm)/LiF (1 nm) /Al (100 nm).

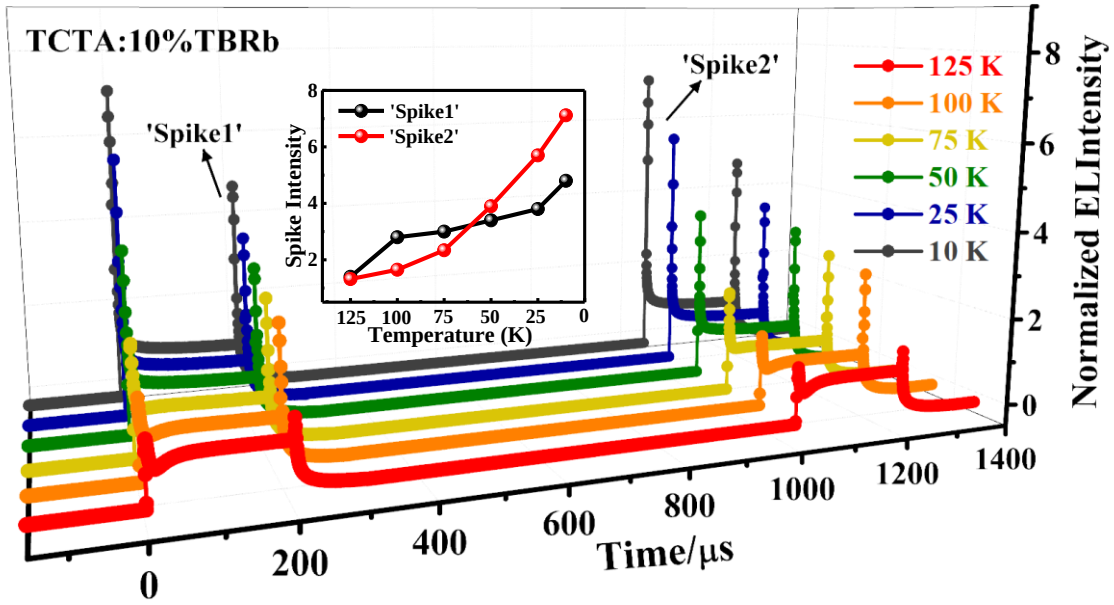

Figure S6. Two cycles of pulsed voltage and TEL response for the devices of ITO/PEDOT:PSS/*m*-MTDATA (60 nm)/TCTA:10%TBRb(40 nm)/Bphen(60 nm)/LiF(1 nm) /Al(100 nm) at 25 μA from 125 K to 10 K. The inset shows the intensity of 'spike1' and 'spike2' from 125 K to 10 K.

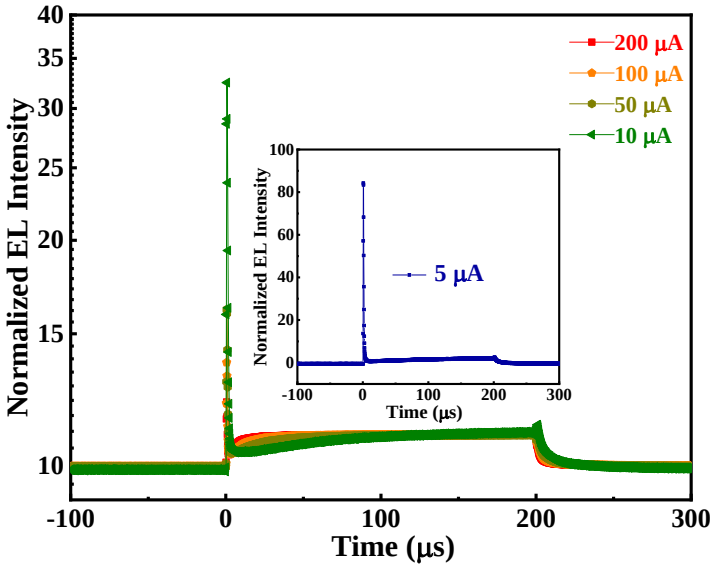

Figure S7. The TEL measurement for the structure of ITO/PEDOT:PSS/*m*-MTDATA (60 nm)/ TCTA:15%TBRb (40 nm)/Alq_3 (60 nm)/LiF (1 nm)/Al (100 nm). The inset shows the corresponding TEL waveform acquired at a current of 5 μA. The spike height is 87 times of the steady-state luminescence intensity.

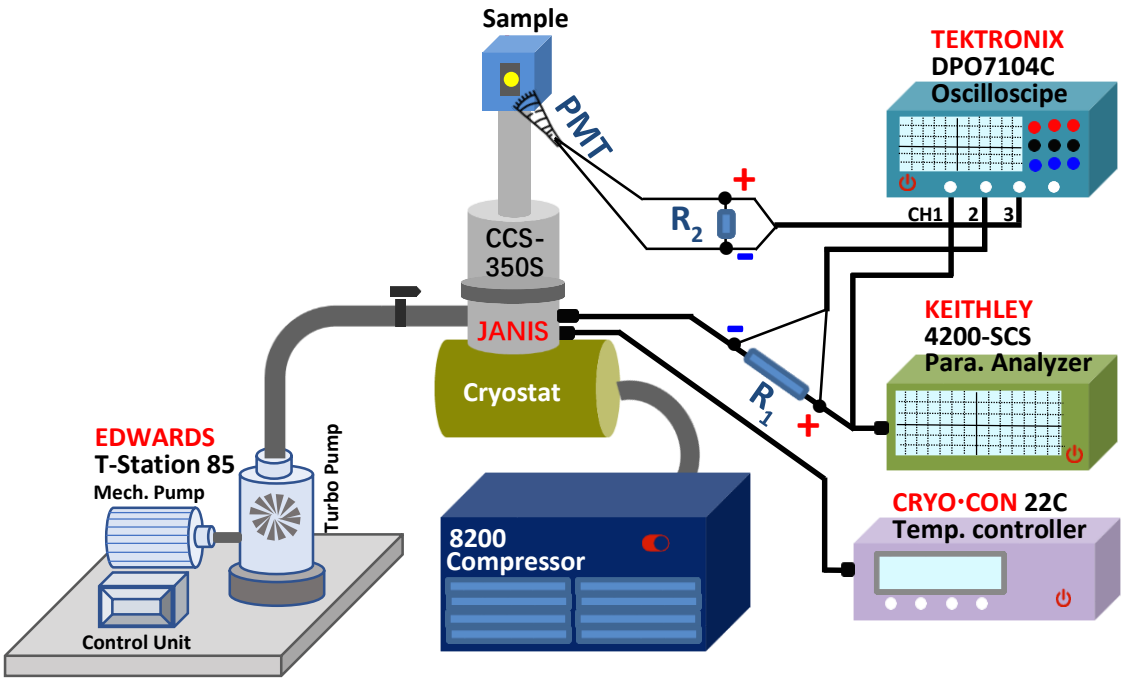

Figure S8. The vacuum system is composed of mechanical pump and molecular pump, the vacuum degree can be less than 10^{-4} Pa. Keithley 4200 is a pulse function generator, which can adjust pulse period, pulse width, pulse height, and frequency. The oscilloscope is mainly used to display the voltage signal collected by the resistance.