

## Supporting Information

### Perovskite/Organic Hybrid Tandem Light-Emitting Diodes with External Quantum Efficiency Over 40%

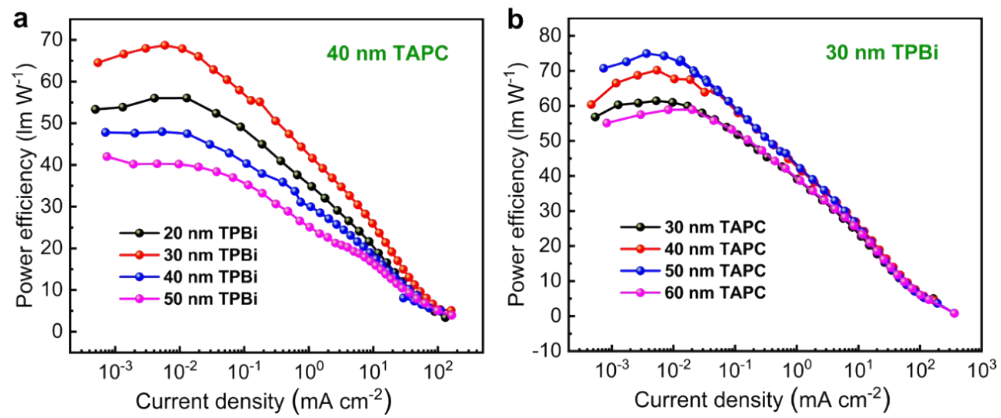
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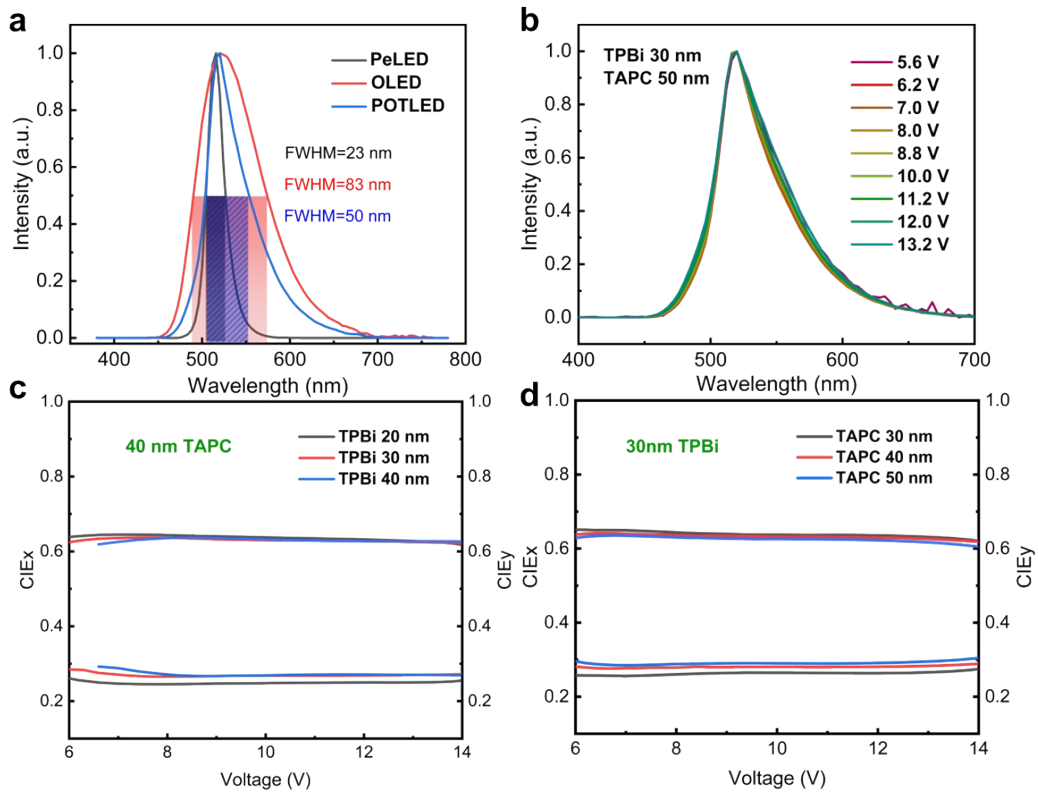
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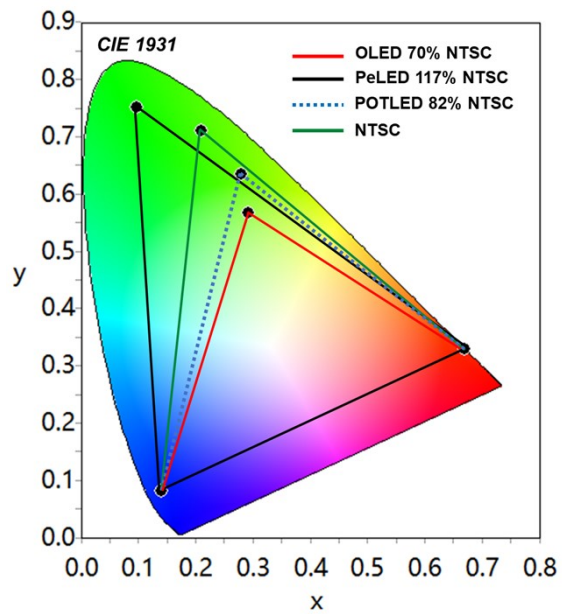
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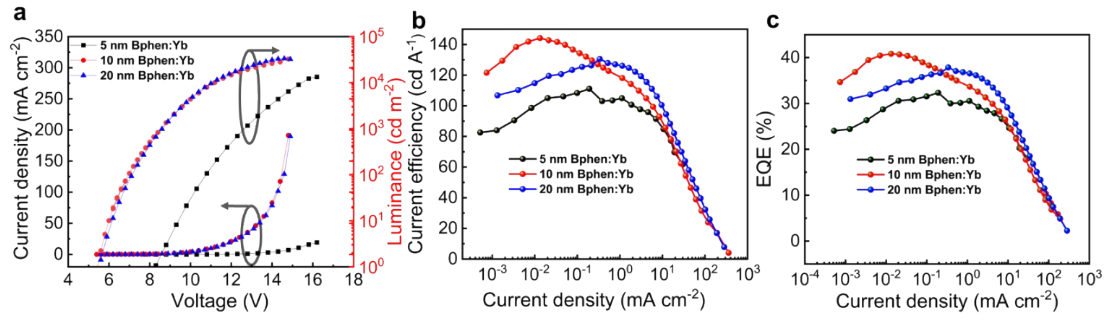
**Fig. S1.** (a) Power efficiency-current density ( $PE$ - $J$ ) curves of 40 nm thick TAPC-based POTLEDs with  $x$  nm TPBi ( $x = 20, 30, 40, 50$ , respectively) and (b)  $PE$ - $J$  curves of 30 nm thick TPBi-based POTLEDs with  $y$  nm TAPC ( $y = 30, 40, 50, 60$ , respectively).



**Fig. S2.** (a) Electroluminescence (EL) spectra of PeLED, OLED and POTLED. (b) EL spectra of 30 nm thick TPBi and 50 nm thick TAPC based POTLED under different applied voltages. (c-d) CIE coordinates of the POTLED devices based on different TPBi and TAPC thicknesses under different applied voltages.



**Fig. S3.** Color gamut of OLED, PeLED, and POTLED with fixed blue and red CIE coordinates with the NTSC standards in a CIE 1931 chromaticity diagram.



**Fig. S4.** (a) Current density and luminance versus voltage ( $J-V-L$ ) plots of POTLEDs with  $x$  nm Bphen:Yb ( $x = 5, 10, 20$ , respectively) and (b) corresponding current efficiency-current density ( $CE-J$ ) curves of the devices and (c) corresponding external quantum efficiency-current density ( $EQE-J$ ) curves of the devices.

**Table S1.** Performance of POTLED devices with different TPBi thicknesses.

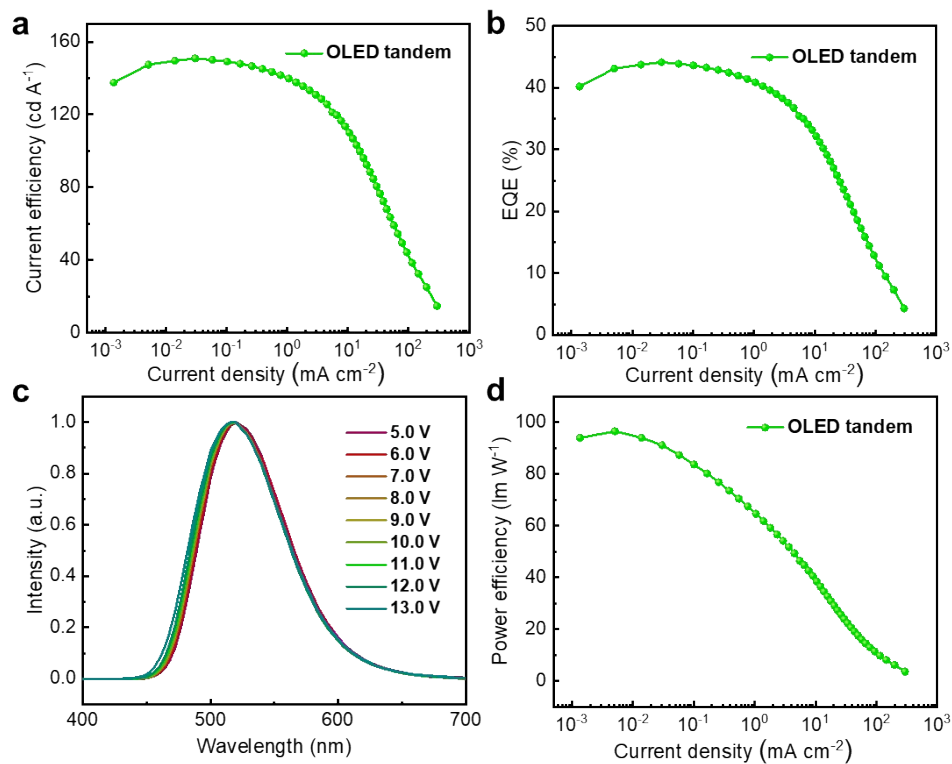
<b>TPBi<sup>a</sup></b> <b>(nm)</b>	<b><math>V_{on}</math><sup>b</sup></b> <b>(V)</b>	<b><math>CE_{max}</math></b> <b>(cd A<sup>-1</sup>)</b>	<b><math>EQE_{max}</math></b> <b>(%)</b>	<b><math>PE_{max}</math></b> <b>(lm W<sup>-1</sup>)</b>	<b><math>L_{max}</math></b> <b>(cd m<sup>-2</sup>)</b>	<b>CIE<sup>c</sup></b> <b>(x, y)</b>
20.0	5.2	110.6	33.1	56.1	20030.0	(0.246, 0.641)
30.0	5.4	130.3	37.8	68.7	36890.0	(0.256, 0.642)
40.0	6.8	117.9	34.1	48.0	31180.0	(0.271, 0.629)
50.0	7.2	110.6	32.3	42.0	30660.0	(0.274, 0.625)

<sup>a</sup> POTLED devices with the TAPC thickness of 40 nm; <sup>b</sup> the voltage at the luminance of 1 cd m<sup>-2</sup>; <sup>c</sup> Commission International de l'Eclairage at about 1000 cd m<sup>-2</sup>.

**Table S2.** Performance of POTLED devices with different TAPC thicknesses.

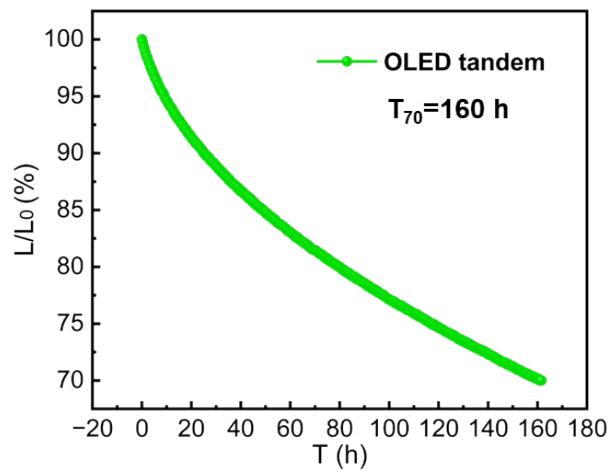
<b>TAPC<sup>a</sup></b> <b>(nm)</b>	<b><math>V_{\text{on}}</math><sup>b</sup></b> <b>(V)</b>	<b><math>CE_{\text{max}}</math></b> <b>(cd A<sup>-1</sup>)</b>	<b><math>EQE_{\text{max}}</math></b> <b>(%)</b>	<b><math>PE_{\text{max}}</math></b> <b>(lm W<sup>-1</sup>)</b>	<b><math>L_{\text{max}}</math></b> <b>(cd m<sup>-2</sup>)</b>	<b>CIE<sup>c</sup></b> <b>(x, y)</b>
30.0	5.4	118.3	35.1	61.5	37690.0	(0.249, 0.638)
40.0	5.4	135.4	39.0	70.2	35450.0	(0.261, 0.642)
50.0	5.4	144.2	41.1	75.0	32630.0	(0.280, 0.635)
60.0	5.4	116.3	33.3	58.9	29790.0	(0.289, 0.629)

<sup>a</sup> POTLED devices with the TPBi thickness of 30 nm; <sup>b</sup> the voltage at the luminance of 1 cd m<sup>-2</sup>; <sup>c</sup> Commission International de l'Eclairage at about 1000 cd m<sup>-2</sup>.

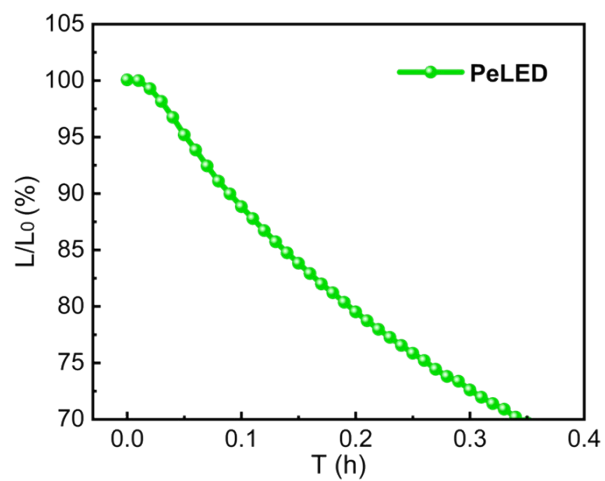


**Fig. S5.** (a)  $CE-J$ , and (b)  $EQE-J$  plots of the tandem OLED device. (c) EL spectra of the OLED tandem device under different applied voltages. (d)  $PE-J$  curve of the tandem OLED device.





**Fig. S6.** Lifetime of tandem OLED at the initial brightness of  $100 \text{ cd m}^{-2}$ .



**Fig. S7.** Lifetime of PeLED at the initial brightness of  $100 \text{ cd m}^{-2}$ .