Supporting Information

Efficient all-fluorescence white organic light-emitting diodes with superior color stability and low efficiency roll-off employing matrix-free blue emitting layers

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Table S1. Performance of monochrome OLEDs

Device	V[a)] (V)	EQE[b)] [%]	CE[b)] [cd A^{-1}]	PE[b)] [lm W^{-1}]	CIE[c)]
1	3.5	14.0/13.2/6.9	29.1/27.2/14.2	29.5/24.4/9.3	(0.183,0.310)
2	3.7	22.8/20.7/18.7	56.1/50.7/46.0	62.9/43.1/30.8	(0.482,0.506)
3	4.1	16.2/11.2/7.3	23.1/16.2/10.4	25.1/12.4/5.1	(0.625,0.368)
4	3.9	7.0/6.1/4.2	11.5/10.3/7.4	11.1/8.3/4.2	(0.532,0.398)
5	3.6	14.5/12.3/8.4	37.7/32.3/21.5	35.9/28.2/13.8	(0.271,0.435)

[a)] At a luminance of 100 cd m^{-2}. [b)] Efficiencies of the maximum, at 100 cd m^{-2} and at 1000 cd m^{-2}. [c)] At a luminance of 100 cd m^{-2}.

1. Comparison of matrix-free and doped EMLs of DMAC-DPS

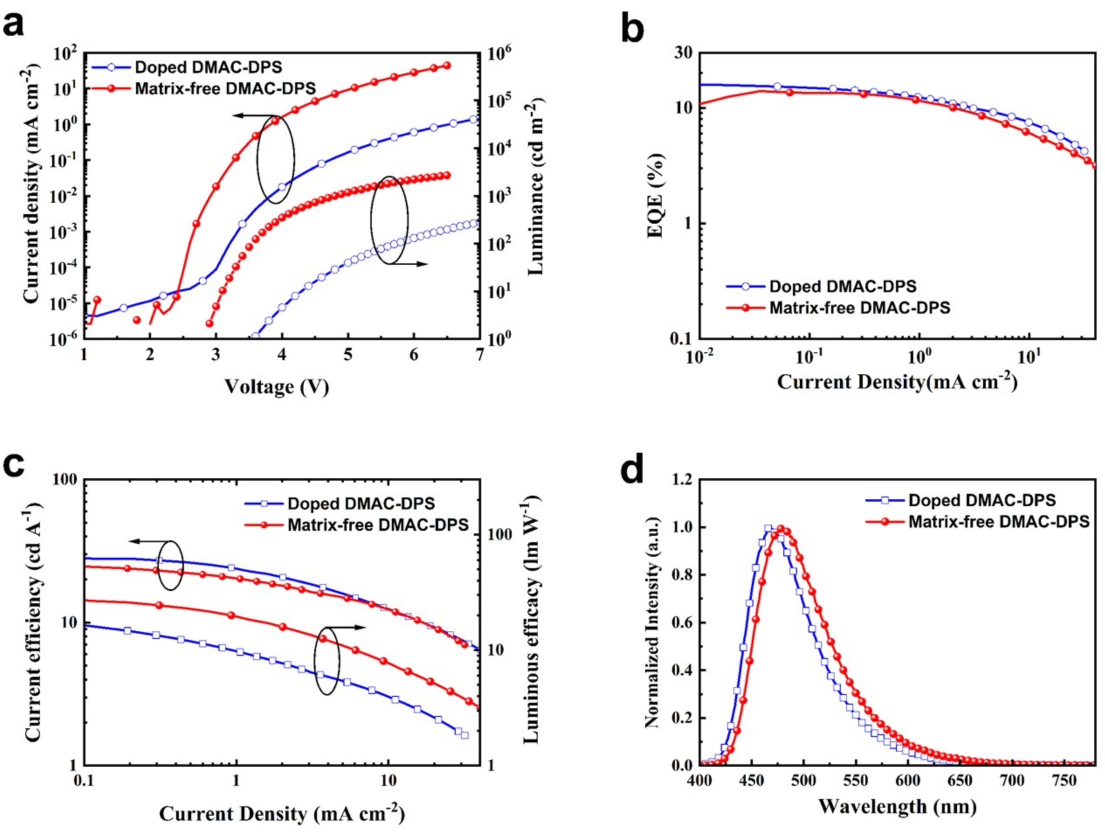

Figure S1. (a) Current density-voltage-luminance curves of blue devices based on matrix-free DMAC-DPS and doped DMAC-DPS; (b) EQE-Current density characteristics of blue OLEDs. (c) Current efficiency and luminous efficacy versus current density curves of blue OLEDs; (d) EL spectra of blue OLEDs at a luminance of 100 cd m^{-2}.

The doped OLED architecture is ITO/HAT-CN (5 nm)/TAPC (40 nm)/TCTA (10 nm)/mCBP (5 nm)/DPEPO:DMAC-DPS(25 nm)/PPF(10 nm)/PBPPhen (40 nm)/Liq (2 nm)/Al (150 nm). As shown in Figure S1, the matrix-free blue OLED shows lower driving voltage than the doped device, which can be attributed to a lower bandgap of DMAC-DPS than that of DPEPO. In the doped OLEDs, the recombine processes take place on the high bandgap host material DPEPO and DMAC-DPS simultaneously, while in the matrix-free device, the recombination occurs directly on DMAC-DPS. Therefore, the doped OLED needs higher driving voltages than the matrix-free one. The lower driving voltage is beneficial for luminance efficacy. As shown in Figure S1c, the matrix-free device demonstrates higher luminance efficacy than the doped one. The matrix-free blue OLED EL emission peaked at 478 nm, which is a slight red-shift compared to the doped devices (468 nm). This is consistent with the reported values.[1, 2]

2. Absorption of DBP and emission spectra of *t*BuCzDBA and DMAC-DPS

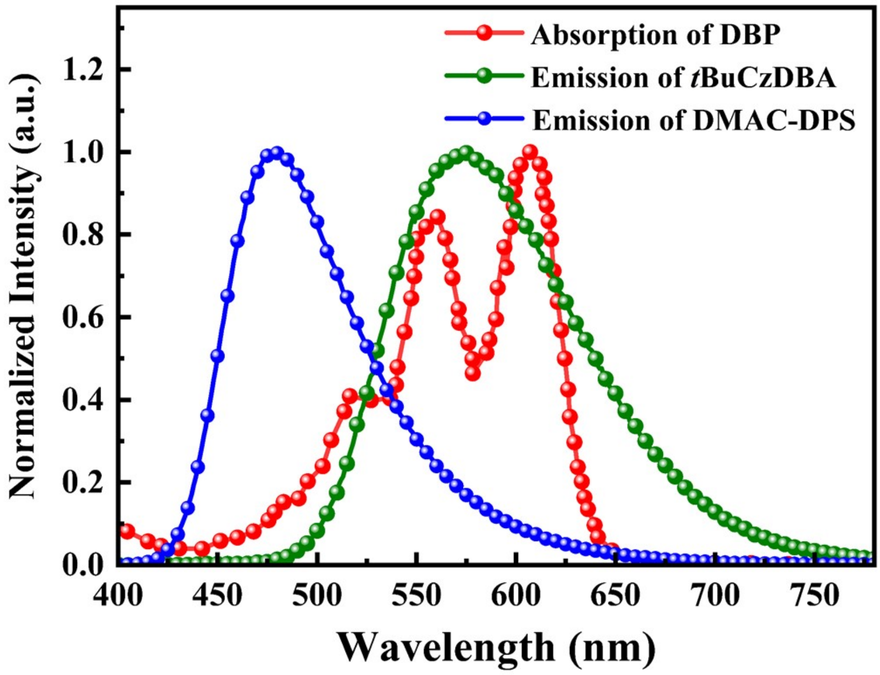

Figure S2. The absorption spectrum of DBP and emission spectra of *t*BuCzDBA and DMAC-DPS.

3. Device architecture of WOLEDs and molecular structures of adopted materials.

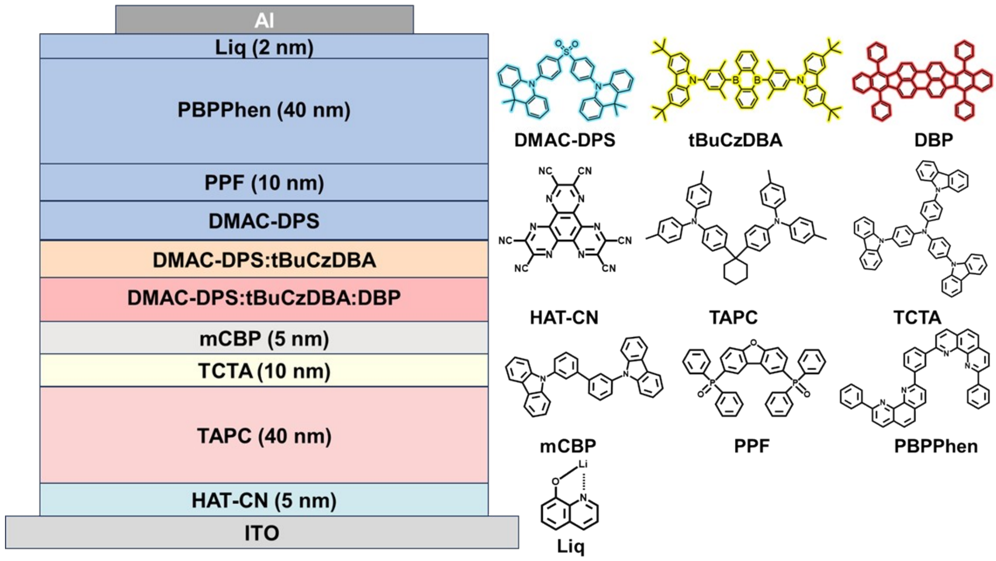

Figure S3. Device architecture of WOLEDs and molecular structures of adopted materials.

4. EL spectra of WOLED W3

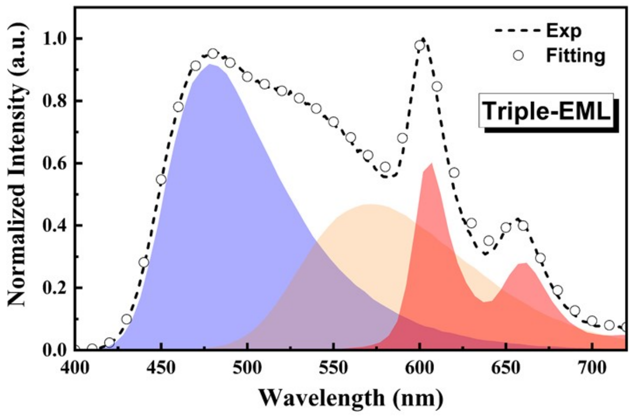

Figure S4. Experimental and fitting EL spectra of device W3.

5. EL spectra of blue OLEDs

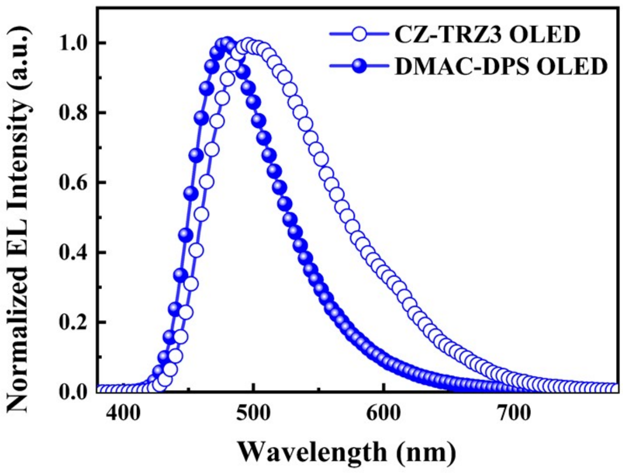

Figure S5. EL spectra of Cz-TRZ3 and DMAC-DPS based blue OLEDs.

6. The CIE coordinated of device W4 change with luminance.

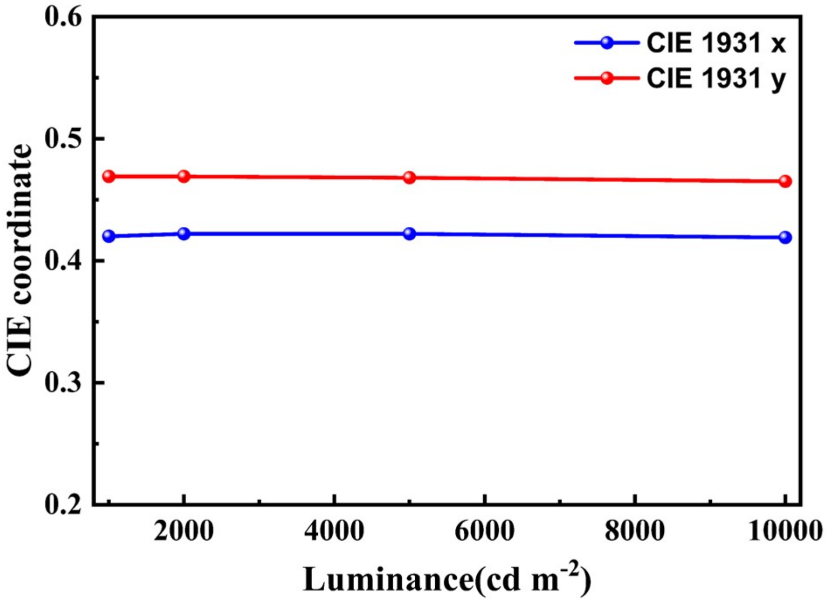

Figure S6. The CIE coordinates of Device W4 as a function of luminance.

1. H. H. Cho, D. G. Congrave, A. J. Gillett, S. Montanaro, H. E. Francis, V. Riesgo-Gonzalez, J. Ye, R. Chowdury, W. Zeng, M. K. Etherington, J. Royakkers, O. Millington, A. D. Bond, F. Plasser, J. M. Frost, C. P. Grey, A. Rao, R. H. Friend, N. C. Greenham and H. Bronstein, *Nat. Mater.*, 2024, **23**, 519-526.
2. Q. Zhang, D. Tsang, H. Kuwabara, Y. Hatae, B. Li, T. Takahashi, S. Y. Lee, T. Yasuda and C. Adachi, *Adv. Mater.*, 2015, **27**, 2096-2100.