### **Supporting information**

# Solution-Processable, High Luminance Deep-Blue Organic Light Emitting Devices Based on Novel Naphthalene Bridged Bis-Triphenylamine Derivatives

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### <sup>1</sup>H-NMR, <sup>13</sup>C-NMR and HRMS of the intermediates and target compounds

## $-7.99 \\ -7.57 \\ -7.36 \\ -7.36 \\ -7.36 \\ -7.15 \\ -7.15 \\ -7.15 \\ -7.12 \\ -7.1$

<sup>1</sup>H NMR (400 MHz, DMSO) δ = 8.00 (dd, *J*=6.5, 3.3, 2H), 7.56 (dd, *J*=6.5, 3.2, 2H), 7.51 (s, 2H), 7.46 (d, *J*=8.5, 4H), 7.38 (t, *J*=7.9, 8H), 7.17 – 7.09 (m, 16H).







Figure S2. <sup>1</sup>H NMR spectrum of compound 2.





Figure S4. <sup>13</sup>C NMR spectrum of compound 3a.



Figure S5. HRMS spectrum of compound 3a









Figure S8. HRMS spectrum of compound 3b







Figure S11. HRMS spectrum of compound 3c







Figure S14. HRMS spectrum of compound 3d











**Figure S18.** AFM images (2 µm×2 µm) of 30 nm emitting layer (compound **3e**) on ITO/glass:



with PVK and PBD

Figure S19. SEM images of EML (compound 3e) on ITO/glass with PVK and PBD; Inset: the

fluorescence pictures of EML with PVK and PBD under 365 nm UV light



Figure S20. The EL spectrum of the devices based on comounds 3a-3e undoped PVK and PBD.



### The carrier mobilities of the target compounds 3a-e

Figure S21. The configurations of OFETs for (a) p-type and (b) n-type devices

**Figure S21** shows the configurations of p-type and n-type OFETs. We fabricated test devices on the substrate of Si/SiO<sub>2</sub>. For the active layer, each compound was dissolved in O-dichlorobenzene (10 mg/mL), and the solution was spray-coated onto the substrates, then annealed with the temperature of 110°C in an argon-filled glove box. The bilayer source and drain electrodes were deposited by vacuum thermal evaporation under a pressure of about  $3 \times 10^{-4}$  Pa.

#### Carrier's mobility calculation



Figure S22. Transfer curves of (a) p-type and (b) n-type devices.

Figure S22 shows the saturation transfer curves of OFETs with five compounds as active layers. The carrier mobility  $\mu$  of active layer has been calculated from the following equation:

$$I_{DS} = C_i (W/2L) \mu (V_{GS} - V_t)^2$$

where L and W are the channel length (30  $\mu$ m) and width (5000  $\mu$ m) of the active layer, and Ci (SiO<sub>2</sub>)  $\approx$  11.5 nF/cm<sup>2</sup> is the capacitance of the 300 nm SiO<sub>2</sub> layer. I<sub>DS</sub> is the channel current between source and drain, and VGS is the bias between gate and source. We can extract the field-effect carrier mobility from the transfer curves based on the above equation. The hole and electron mobility are shown in table S1. It is

obvious that these compounds show the relatively higher hole mobility ( $\sim 10^{-5} \text{ cm}^2/\text{V} \cdot \text{s}$ ) than the electron mobility ( $\sim 10^{-7} \text{ cm}^2/\text{V} \cdot \text{s}$ ). So for the p-type composite emitting layer (EML) of PVK: compound, the electron transport material PBD was co-doped into the EML to balance the carrier injection under the electric field. As a result, the balanced hole-electron pairs will increase the exciton recombination rate so as to enhance the electroluminescent performance of OLEDs.

Compound	3a	3b	3c	3d	3e
Hole mobility ( $cm^2/V \cdot s$ )	6.3×10 <sup>-5</sup>	3.2×10 <sup>-5</sup>	5.7×10 <sup>-5</sup>	4.8×10 <sup>-5</sup>	8.1×10 <sup>-5</sup>
Electron mobility (cm <sup>2</sup> /V·s)	1.7×10 <sup>-7</sup>	3.8×10 <sup>-7</sup>	2.3×10 <sup>-7</sup>	3.1×10 <sup>-7</sup>	1.2×10 <sup>-7</sup>

Table S1. Field-effect carrier mobility of each compound



Figure S23. Absorption spectrum (a) and PL spectrum (b) in different solution of 3a.



Figure S24. Absorption spectrum (a) and PL spectrum (b) in different solution of 3b.







Figure S26. Absorption spectrum (a) and PL spectrum (b) in different solution of 3d.



Figure S27. Absorption spectrum (a) and PL spectrum (b) in different solution of 3e.



**Figure S27.** Plots of the Stokes shift ( $v_{a^{-}} v_{f}$ ) of the new compounds against orientation polarization (f) of solvent.

Material	Solvents	PhMe	CHCl <sub>3</sub>	THF	DCM	DMSO
	ε <sup>a</sup>	2.38	4.81	7.58	8.93	48.9
	n <sup>b</sup>	1.4969	1.4467	1.4050	1.424	1.4795
	f <sup>c</sup>	0.0132	0.1478	0.2096	0.2172	0.2641
3a	UV <sup>d</sup> (nm)	349	350	352	351	348
	PL <sup>e</sup> (nm)	465	472	480	487	495
	$v_a$ - $v_f$ <sup>f</sup> (cm <sup>-1</sup> )	7148	7388	7576	7956	8534
3b	UV <sup>d</sup> (nm)	354	357	355	356	354
	PL <sup>e</sup> (nm)	458	469	476	483	491
	$v_a$ - $v_f$ <sup>f</sup> (cm <sup>-1</sup> )	6908	6689	7161	7386	7882
3c	UV <sup>d</sup> (nm)	352	353	351	353	354
	PL <sup>e</sup> (nm)	466	471	479	486	493
	$v_a$ - $v_f$ <sup>f</sup> (cm <sup>-1</sup> )	6950	7097	7613	7753	7965
3d	UV <sup>d</sup> (nm)	351	350	353	351	354
	PL <sup>e</sup> (nm)	461	470	477	486	494
	$v_a$ - $v_f$ <sup>f</sup> (cm <sup>-1</sup> )	6798	7295	7364	7914	8006
3e	UV <sup>d</sup> (nm)	346	348	347	346	345
	PL <sup>e</sup> (nm)	467	476	482	487	496
	$v_a$ - $v_f$ <sup>f</sup> (cm <sup>-1</sup> )	7488	7727	8072	8368	8824

Table S2. Detailed photophysical data of compounds 3a-e in different solvents

<sup>a</sup>Dielectric constant; <sup>b</sup>Refractive index; <sup>c</sup>Orientation polarization of solvents, calculated from  $f = (\epsilon -1)/(2 \epsilon +1)-(n^2-1)(2n^2+1)$ ; <sup>d</sup>Absorption and <sup>e</sup>fluorescence emission maximum; <sup>f</sup>Stokes shift.