**Electronic Supplementary Information (ESI)**

**Full emission color tuning in luminogens constructed from tetraphenylethene, benzo-2,1,3-thiadiazole, and thiophene building blocks**

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**Experimental**

**General**

THF was distilled from sodium benzophenone ketyl under dry nitrogen immediately prior to use. Compound 1\textsuperscript{1}, 2\textsuperscript{1}, 3\textsuperscript{2}, 5\textsuperscript{2}, 7\textsuperscript{2}, and 8\textsuperscript{2} were prepared according to the literature methods. All other chemicals and regents were purchased from Aldrich and used as received without further purification. \textsuperscript{1}H and \textsuperscript{13}C NMR spectra were measured on a Bruker AV 300 spectrometer in deuterated chloroform using tetramethylsilane (TMS; \(\delta = 0\)) as internal reference. UV spectra were measured on a Milton Roy Spectronic 3000 Array spectrophotometer. Photoluminescence was recorded on a Perkin-Elmer LS 55 spectrofluorimeter. High resolution mass spectra were recorded on a GCT premier CAB048 mass spectrometer operating in a MALDT-TOF mode. Thermogravimetric analysis was carried on a TA TGA Q5000 under dry nitrogen at a heating rate of 10 °C/min. Thermal transitions were investigated by differential scanning calorimetry using a TA DSC Q1000 under dry nitrogen at a heating rate of 10 °C/min. The ground-state geometries were optimized using the density functional (DFT) with B3LYP
hybrid functional at the basis set level of 6-31G (d). All the calculations were performed using Gaussian 03 package.

Device fabrication

The devices were fabricated on 80 nm-ITO coated glass with a sheet resistance of $25\,\Omega/\square$. Prior to load into the pretreatment chamber, the ITO-coated glasses were soaked in ultrasonic detergent for 30 min, followed by spraying with de-ionized water for 10 min, soaking in ultrasonic de-ionized water for 30 min, and oven-baking for 1 h. The cleaned samples were treated by perfluoromethane (CF$_4$) plasma with a power of 100 W, gas flow of 50 sccm, and pressure of 0.2 Torr for 10 s in the pretreatment chamber. The samples were transferred to the organic chamber with a base pressure of $7 \times 10^{-7}$ Torr for the deposition of $N,N$-bis(1-naphthyl)-$N,N$-diphenylbenzidine (NPB), emitter, $2,2',2''$-(1,3,5-benzenetriyl)tris(1-phenyl-1-$H$-benzimidazole) (TPBi), and tris(8-hydroxyquinolinolato)aluminum (Alq$_3$), which served as hole-transporting, light-emitting, hole-blocking, and electron-transporting layers, respectively. The samples were then transferred to the metal chamber for cathode deposition which composed of lithium fluoride (LiF) capped with aluminum (Al). The light-emitting area was 4 mm$^2$. The current density-voltage characteristics of the devices were measured by a HP4145B semiconductor parameter analyzer. The forward direction photons emitted from the devices were detected by a calibrated UDT PIN-25D silicon photodiode. The luminance and external quantum efficiencies of the devices were inferred from the photocurrent of the photodiode. The electroluminescence spectra were obtained by a PR650 spectrophotometer. All measurements were carried out under air at room temperature without device encapsulation.

Synthesis

Compound 6$^2$ and 8$^2$ were prepared according to the literature methods. Their characterization data are given below.
4,7-Bis(5-bromo-2-thienyl)benzo-2,1,3-thiadiazole (6): $^1$H NMR (300 MHz, CDCl$_3$), $\delta$ (TMS, ppm): 7.81 (d, 2H, $J$ = 3.9 Hz), 7.80 (s, 2H), 7.16 (d, 2H, $J$ = 4.2 Hz). $^{13}$C NMR (75 MHz, CDCl$_3$), $\delta$ (TMS, ppm): 152.5, 140.9, 131.1, 127.7, 125.8, 125.4, 115.1. HRMS: $m/z$ 457.8054 (M$^+$, calcld 457.8039).

4-Bromo-7-(5-bromo-2-thienyl)benzo-2,1,3-thiadiazole (8): $^1$H NMR (300 MHz, CDCl$_3$), $\delta$ (TMS, ppm): 7.85 (d, 1H, $J$ = 7.5 Hz), 7.79 (d, 1H, $J$ = 3.9 Hz), 7.65 (d, 1H, $J$ = 7.8 Hz), 7.15 (d, 1H, $J$ = 3.9 Hz). $^{13}$C NMR (75 MHz, CDCl$_3$), $\delta$ (TMS, ppm): 154.4, 152.2, 140.5, 132.9, 131.5, 128.4, 126.9, 126.0, 115.8, 113.5. HRMS: $m/z$ 375.8160 (M$^+$, calcld 375.8162).

4,7-Bis[4-(1,2,2-triphenylvinyl)phenyl]benzo-2,1,3-thiadiazole (BTPETD): A mixture of 3 (0.29 g, 1 mmol), 2 (0.82 g, 2.2 mmol), Pd(PPh$_3$)$_4$ (0.11 g, 0.1 mmol), and potassium carbonate (1.1 g, 8 mmol) in 100 mL of toluene/ethanol/water mixture (8/1/1 v/v/v) was heated to reflux for 12 h under nitrogen. After filtration and solvent evaporation, the residue was purified by silica-gel column chromatography using hexane/dichloromethane mixture as eluent. Greenish yellow solid of BTPET was obtained in 86% yield (0.68 g). $^1$H NMR (300 MHz, CDCl$_3$), $\delta$ (TMS, ppm): 7.77 (d, 4H, $J$ = 8.4 Hz), 7.72 (s, 2H), 7.20–7.04 (m, 34H). $^{13}$C NMR (75 MHz, CDCl$_3$), $\delta$ (TMS, ppm): 154.7, 146.1, 144.5, 144.4, 144.3, 142.2, 141.2, 135.9, 133.3, 132.3, 132.2, 132.1, 129.0, 128.6, 128.5, 128.4, 128.3, 127.3, 127.2. HRMS: $m/z$ 796.2905 (M$^+$, calcld 796.2912).

Compound BTPETTD and BTPEBTTD are prepared by an analogous method as described for BTPETD.

4-[4-(1,2,2-Triphenylvinyl)phenyl]-7-[5-[4-(1,2,2-triphenylvinyl)phenyl]-2-thienyl]benzo-2,1,3-thiadiazole (BTPETTD): Orange-red solid; yield 75%. $^1$H NMR (300 MHz, CDCl$_3$), $\delta$ (TMS, ppm): 8.08 (d, 1H, $J$ = 3.6 Hz), 7.89 (d, 1H, $J$ = 7.2 Hz), 7.77 (d, 2H, $J$ = 8.7 Hz), 7.70 (d, 1H, $J$ = 7.8 Hz), 7.45 (d, 2H, $J$ = 8.1 Hz), 7.36 (d, 1H, $J$ = 3.9 Hz), 7.20–7.04 (m, 34H). $^{13}$C NMR (75 MHz, CDCl$_3$), $\delta$ (TMS, ppm): 153.4, 146.1, 144.5, 144.4, 144.3, 144.2, 144.1, 142.2, 142.0, 141.2, 141.0, 139.1, 135.8, 139.8, 132.6, 132.3, 132.2, 132.0, 129.3, 129.0, 128.5, 128.4, 128.3, 127.2, 126.8, 126.0, 125.6, 124.5. HRMS: $m/z$ 878.2714 (M$^+$, calcld 878.2789).
**4,7-Bis{5-(4-[1,2,2-triphenylvinyl]phenyl)-2-thienyl}benzo-2,1,3-thiadiazole (BTPEBTTD):** Red solid; yield 72%. $^1$H NMR (300 MHz, CDCl$_3$), $\delta$ (TMS, ppm): 8.08 (d, 2H, $J = 3.9$ Hz), 7.86 (s, 2H), 7.45 (d, 4H, $J = 8.1$ Hz), 7.35 (d, 2H, $J = 3.6$ Hz), 7.13–7.05 (m, 34H). $^{13}$C NMR (75 MHz, CDCl$_3$), $\delta$ (TMS, ppm): 153.3, 146.1, 144.3, 144.2, 144.1, 142.1, 141.0, 139.1, 132.7, 132.6, 132.0, 129.3, 128.5, 128.4, 127.2, 126.4, 125.9, 125.6, 124.7, 124.6. HRMS: $m/z$ 960.2673 (M$,^+$, calcld 960.2667).

![Scheme S1](image)

**Scheme S1.** Synthetic routes to the TPE-substituted heterocyclics.

![Fig. S1](image)

**Fig. S1.** (A) Change in luminance and current density with voltage and (B) current efficiency versus current density curves of multilayer EL devices of BTPETD, BTPETTD, and BTPEBTTD.
References
