Electronic Supporting Information

A novel boron-stereogenic fluorophore with dual-state circular polarization luminescence via self-dispersing strategy

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Table of Contents

1.	General information	S2
2.	Synthesis and characterization	S4
3.	Crystal diagrams and selected parameters	.S12
4.	Spectroscopic data and spectra	.S21
5.	Electrochemical properties	S41
6.	Density functional theory calculations	.S42
7.	Chiral HPLC separation	.S43
8.	Chiroptical properties	S52
9.	Electroluminescence performance	S56
10.	NMR spectra for the new BOPSHs	S58
11.	HRMS for the new BOPSHs	.S78

1. General information

Reagents and solvents were used as received from commercial suppliers unless noted otherwise. All reactions were performed in oven-dried or flame-dried glassware unless otherwise stated and monitored by thin layer chromatography (TLC) using 0.25 mm silica gel plates with UV indicator. ¹H and ¹³C NMR were recorded on a 400 MHz or 500 MHz NMR spectrometer at room temperature. Chemical shifts (δ) were given in ppm relative to internal TMS in CDCl₃ (7.26 ppm for ¹H and 77 ppm for ¹³C) or acetone*d*₆ (2.05 ppm for ¹H, and 207 ppm and 31 ppm for ¹³C). ¹¹B NMR spectra were calibrated using BF₃·Et₂O (0.0 ppm) and and CF₃CO₂H (0.0 ppm) as external references, respectively. High-resolution mass spectra (HRMS) were obtained using quadrupole-time-of-flight mass spectrometers with ESI or APCI ion source in positive mode.

Crystals of **1a**, **1e**, **1h-k** and **2e** suitable for X-ray analysis were obtained by slow diffusion of hexane into their dichloromethane solutions. Data collection were performed at 298(2) K on Bruker D8 Venture diffractometer equipped with Photon II detector, using graphite monochromated Cu K_{α} radiation ($\lambda =$ 1.54178 Å) for the crystals. The determination of the crystal class and unit cell parameters was carried out by the SMART program packages.^[1] The raw frame data were processed using SAINT^[2] and absorption corrections using SADABS^[3] to yield the reflection data file. All the structures were solved by using structure solution program SHELXT with Intrinsic Phasing method^[4] in the OLEX2 software^[5]. Refinements were performed on F^2 anisotropically for all the non-hydrogen atoms by the full-matrix leastsquares method using SHELXL program^[6] in OLEX2 software. All the hydrogen atoms were placed at the calculated positions and were refined as riding model. Residual electron densities observed were deemed to have no significant chemical implications. The supplementary crystallographic data for this study are available in the CCDC under the deposition numbers 2116412 (**1a**), 2389168 (**1e**), 2116411 (**1h**), 2116409 (**1i**), 2151717 (**1k**) and 2251718 (**2e**).

UV-visible absorption and fluorescence emission spectra were recorded on commercial spectrophotometers (190-1100 nm scan range) at room temperature (10-mm quartz cuvette). Absolute fluorescence quantum yields of dyes **1a-k** and **2a-e** in different solvents and the solid state are measured by comparing the areas under the corrected emission spectrum of the test sample using integrating sphere according to the definition of fluorescence efficiency. ^[7] We performed their chiral separation of respective BOPSHs **1a**, **1i** and **1j** and analysis by normal phase high-pressure liquid chromatography (HPLC) using a chiral Ig, Ib and Ic column, respectively.

Cyclic voltammograms of BOPSHs **1a** and **1h-j** were measured in dichloromethane with the concentration of 1 mM, containing 0.1 M tetrabutylammonium hexafluorophosphate as the supporting electrolyte, glassy carbon electrode as a working electrode, Pt wire as a counter electrode, and Ag/AgCl electrode as reference electrode at 20 mV s⁻¹ of scanning rate at room temperature. Fc⁺/Fc was used as external reference. Argon was bubbled for 10 min before each measurement.

The ground state geometry was optimized employing the density functional theory (DFT) calculation method at the B3LYP-D3BJ/6-311G(d,p) level of theory. To validate that the optimized structures indeed correspond to local minima on the energy surface, vibrational analysis was conducted using the same methodology. Subsequently, time-depended (TD)-DFT computations were performed on the optimized ground state geometries, utilizing the CAM-B3LYP/6-311+G(d,p) theoretical level. For calculations involving the molecule in dichloromethane, the Self-Consistent Reaction Field (SCRF) method with the Polarizable Continuum Model (PCM) was employed. All computations pertaining to **1a**, **1i** and **1j** were executed utilizing the methods incorporated within the Gaussian 09 software package. ^[8] The magnetic and electronic transition moment densities were calculated at the CAM-B3LYP/6-311+G(d,p)/(IEFPCM, dichloromethane) level for respective BOPSHs **1a** and **1i** with an isovalue of 0.005.

Circular dichroism (CD) spectra were obtained on a BioLogic MOS-500 circular dichroism spectrometer. Samples of respective BOPSHs (*R/S*)-**1a**, (*R/S*)-**1i** and (*R/S*)-**1j** were prepared for testing in quartz cuvettes with light path of 0.1 mm. For the CD spectroscopy, the difference in absorbance between the left and right circularly polarized light, represented as $CD = \Delta A = A_{LCP} - A_{RCP}$, was calculated. The delta absorbance (ΔA) was determined using the Beer-Lambert law, which stated that $\Delta A = (\varepsilon_L - \varepsilon_R) C \cdot L = \Delta \varepsilon \cdot C \cdot L$ (where A represents absorbance, $\Delta \varepsilon$ represents molar circular dichroism, C represents molar concentration, and L represents cuvette pathlength). CD spectra were obtained using the Bio-Kine Software, with θ being the unit displayed in mdeg (one mdeg equals 0.001 deg) and is also known as standard ellipticity. To convert ellipticity to circular dichroic absorption (ΔA or ΔOD), the following equation was used: $\Delta A = \Delta OD = \theta/32980$. The parameter g_{abs} is calculated as $\Delta A/A$, with values ranging from -1 to 1.

Circularly polarized luminescence (CPL) measurements of respective BOPSHs (*R/S*)-**1a**, (*R/S*)-**1i** and (*R/S*)-**1j** were performed on an OLIS CPL SOLO spectrometer. The performance of CPL was evaluated by the luminescence dissymmetry factor (g_{lum}). $g_{lum} = 2(I_L - I_R)/(I_L + I_R)$ ($-2 \le g_{lum} \le 2$), where I_L and I_R mean the strength of the left and right circularly polarized emissions. To calibrate the CPL spectrometer, standard Eu(facam)₃ (Europium(III) tris[3-(trifluoromethylhydroxymethylene)-d-camphorate]) (1 mM in

DMSO) was used. The emission wavelength range was set from 570 nm to 640 nm. The theoretical value of g_{lum} for Eu(facam)₃ has been reported to peak at approximately -0.78 at 595 nm. The measured value was about -0.77 at 595 nm, which was agreed to the theoretical value. For the CPL test of a chiral BOPSH system, the sample was shaken and placed in a quartz cell. For the solid CPL, KBr and our BOPSH (mass ratio = 50:1) were carefully grounded together and pressed onto two quartz slides. A number of spectra were accumulated and then averaged to reduce the influence of accidental errors. All samples were excited at 390 nm unless otherwise noted. The CPL spectra of (*R/S*)-**1a**, (*R/S*)-**1i** and (*R/S*)-**1j** in the solution and solid states in the KBr system were presented mirror-image signals.

OLEDs fabrication: The glass substrates precoated with a 90-nm layer of indium tin oxide (ITO) with a sheet resistance of 15~20 Ω per square are successively cleaned in ultrasonic bath of acetone, isopropanol, detergent and deionized water, respectively, taking 10 minutes for each step. Then, the substrates are totally dried in a 70 °C oven. Before the fabrication processes, in order to improve the hole injection ability of ITO, the substrates are treated by O₂ plasma for 10 minutes. The vacuum-deposited OLEDs are fabricated under a pressure of $< 1 \times 10^{-5}$ Pa in the Fangsheng OMV-FS450 vacuum deposition system. Organic materials, LiF and Al are deposited at rates of $1 \sim 2$ A s⁻¹, 0.1 A s⁻¹ and 4 A s⁻¹, respectively. The effective emitting area of the devices is 9 mm^2 , determined by the overlap between anode and cathode. The EL spectra, luminance-voltage-current density and external quantum efficiency characterized with a Keithley 2400 Source Meter and a PhotoResearch PR670 spectroradiometer. The external quantum efficiencies are estimated utilizing the normalized EL spectra and the current efficiencies of the devices, assuming that the devices are Lambertian emitters. Circularly polarized electroluminescence (CPEL) spectra were recorded at 100 nm min⁻¹ scan speed with a commercialized instrument JASCO CPL-300 at room temperature, and the devices were encapsulated before testing. The CP-EL spectra of each simple were further examined by rotation 90° and 180°, the profiles were almost the same with 0° .

2. Synthesis and characterization

General synthetic procedure for BOPSHs 1a-k:

To pyrrole-2-carboxaldehyde derivative (PA, 1.0 mmol) and salicylhydrazide (167 mg, 1.1 mmol) in dried chlorobenzene (20 mL) was added several drops of glacial acetic acid (HOAc) slowly. The reaction mixture was refluxed at 105 °C oil bath for 6 h, and TLC was used to follow the reaction. After pyrrole-2-carboxaldehyde derivative disappeared on TLC, K_3PO_4 (690 mg, 3.0 mmol, 3 equiv) and corresponding arylboronic acid (9.0 mmol, 9 equiv.) were added into the mixture, respectively. The reaction was then left stirring in a sealed tube at 140 °C oil bath overnight. After completion of the reaction, the reaction mixture was poured into water (150 mL), and then extracted with CH_2Cl_2 (3 × 60 mL). The organic layers were combined, dried over anhydrous Na₂SO₄, filtered and evaporated under vacuum. The crude product was purified by silica gel column chromatography and the yellow (or red) powders **1a-k** were obtained by recrystallization from dichloromethane and hexane.

Synthesis of BOPSH 1a: BOPSH 1a was prepared and purified (silica gel, hexane/CH₂Cl₂ = 2.5/1, v/v) as a light-yellow powder (426 mg) in 89% yield from pyrrole-2-carbaldehyde (95 mg, 1 mmol), salicylhydrazide (168 mg, 1.1 mmol) and benzeneboronic acid (1.10 g, 9.0 mmol, 9 equiv.). ¹H NMR (500 MHz, CDCl₃) δ 7.85 (d, *J* = 7.9 Hz, 1H), 7.69 (s, 1H), 7.63 – 7.57 (m, 2H), 7.47 – 7.40 (m, 4H), 7.34 – 7.32 (m, 3H), 7.32 – 7.27 (m, 3H), 7.23 – 7.18 (m, 1H), 7.12 – 7.07 (m, 1H), 7.07 – 7.03 (m, 4H), 7.00 – 6.95 (m, 2H), 6.52 – 6.50 (m, 1H). ¹³C NMR (126 MHz, CDCl₃) δ 164.0, 161.1, 142.9, 138.4, 137.9, 134.8, 133.1, 131.6, 130.2, 128.5, 128.1, 127.9, 127.7, 127.6, 127.5, 124.8, 123.5, 120.2, 120.0, 115.9, 110.2. ¹¹B NMR (128 MHz, CDCl₃) δ 12.04 (brs), 4.05 (brs). HRMS (APCI) Calcd. For C₃₀H₂₄B₂N₃O₂ [M + H]⁺: 480.2055, found 480.2069.

Synthesis of BOPSH 1b: BOPSH 1b was prepared and purified (silica gel, hexane/CH₂Cl₂ = 3/1, v/v) as a light-yellow powder (496 mg) in 77% yield from pyrrole-2-carbaldehyde (95 mg, 1 mmol), salicylhydrazide (168 mg, 1.1 mmol) and 4-tert-butylbenzeneboronic acid (1.60 g, 9.0 mmol, 9 equiv.). ¹H NMR (500 MHz, CDCl₃) δ 7.83 (dd, *J* = 7.9, 1.8 Hz, 1H), 7.69 (s, 1H), 7.60 – 7.56 (m, 2H), 7.39 (d, *J* = 7.9 Hz, 2H), 7.35 (d, *J* = 7.9 Hz, 2H), 7.31 (d, *J* = 8.2 Hz, 2H), 7.28 (s, 2H), 7.18 (d, *J* = 8.4 Hz, 1H), 7.05 (d, *J* = 7.8 Hz, 2H), 6.97 – 6.93 (m, 2H), 6.91 (d, *J* = 7.7 Hz, 2H), 6.50 (dd, *J* = 3.9, 2.1 Hz, 1H), 1.32-1.31 (m, 18H), 1.19 (s, 9H). ¹³C NMR (126 MHz, CDCl₃) δ 163.9, 161.3, 150.8, 150.2, 150.1, 138.1, 137.8, 134.4, 133.0, 131.7, 130.0, 128.5, 125.0, 124.8, 124.5, 124.3, 123.0, 120.0, 120.0, 115.5, 110.3, 34.6, 34.5, 34.3, 31.4, 31.4, 31.3. ¹¹B NMR (128 MHz, CDCl₃) δ 5.11 (brs), -1.03 (brs). HRMS (APCI) Calcd. For C₄₂H₄₈B₂N₃O₂ [M + H]⁺: 648.3933, found 648.3935.

Synthesis of BOPSH 1c: BOPSH 1c was prepared and purified (silica gel, hexane/CH₂Cl₂ = 3/1, v/v) as a yellow powder (834 mg) in 68% yield from pyrrole-2-carbaldehyde (95 mg, 1 mmol), salicylhydrazide (168 mg, 1.1 mmol) and 4-bromobenzeneboronic acid (1.81 g, 9.0 mmol, 9 equiv.). ¹H NMR (500 MHz, CDCl₃) δ 7.83 (dd, *J* = 7.9, 1.9 Hz, 1H), 7.65 – 7.59 (m, 3H), 7.45 (ddd, *J* = 10.6, 5.4, 2.2 Hz, 4H), 7.25 – 7.18 (m, 7H), 7.05 – 6.99 (m, 2H), 6.86 (ddd, *J* = 8.1, 3.7, 1.9 Hz, 2H), 6.55 (dd, *J* = 3.7, 1.6 Hz, 1H). ¹³C NMR (126 MHz, CDCl₃) δ 164.1, 161.0, 139.0, 138.1, 135.6, 134.9, 133.2, 132.0, 131.3, 131.1, 130.9, 128.6, 124.9, 124.6, 123.2, 122.5, 122.2, 120.7, 120.2, 116.6, 109.9. ¹¹B NMR (128 MHz, CDCl₃) δ 10.96, 3.64. HRMS (APCI) Calcd. For C₃₀H₂₁B₂Br₃N₃O₂ [M + H]⁺: 713.9370, found 713.9382.

Synthesis of BOPSH 1d: BOPSH 1d was prepared and purified (silica gel, hexane/CH₂Cl₂ = 3/1, v/v) as a light-yellow powder (545 mg) in 80% yield from pyrrole-2-carbaldehyde (95 mg, 1 mmol), salicylhydrazide (168 mg, 1.1 mmol) and 4-tert-trifluoromethylbenzeneboronic acid (1.71 g, 9.0 mmol, 9 equiv.). ¹H NMR (500 MHz, CDCl₃) δ 7.86 (dd, *J* = 7.9, 1.8 Hz, 1H), 7.69 (d, *J* = 1.0 Hz, 1H), 7.66 (ddd, *J* = 8.9, 7.3, 1.8 Hz, 1H), 7.63 (dt, *J* = 2.2, 1.1 Hz, 1H), 7.59 (d, *J* = 8.0 Hz, 2H), 7.55 (d, *J* = 7.7 Hz, 2H), 7.49 (dd, *J* = 8.0, 2.6 Hz, 4H), 7.28 (d, *J* = 7.9 Hz, 2H), 7.24 (d, *J* = 8.0 Hz, 1H), 7.10 (dd, *J* = 4.0, 1.2 Hz, 1H), 7.08 (d, *J* = 7.7 Hz, 2H), 7.04 (ddd, *J* = 8.0, 7.3, 1.0 Hz, 1H), 6.58 (dd, *J* = 4.0, 2.1 Hz, 1H). ¹³C NMR (126 MHz, CDCl₃) δ 164.2, 160.9, 146.9, 146.0, 139.2, 138.1, 136.0, 133.3, 131.5, 130.6 (q, *J* = 3.8 Hz, F-C), 124.6 (q, *J* = 3.8 Hz, F-C), 124.3 (q, *J* = 3.8 Hz, F-C), 124.6 (q, *J* = 3.8 Hz, F-C), 124.3 (q, *J* = 3.8 Hz, F-C), 124.6 (brs), 4.05 (brs). HRMS (APCI) Calcd. For C₃₃H₂₁B₂F₉N₃O₂ [M + H]⁺: 684.1676, found 684.1672.

Synthesis of BOPSH 1e: BOPSH 1e was prepared and purified (silica gel, hexane/CH₂Cl₂ = 3/1, v/v) as a light-yellow powder (473 mg) in 79% yield from pyrrole-2-carbaldehyde (95 mg, 1 mmol), salicylhydrazide (168 mg, 1.1 mmol) and 3,5-ditrifluoromethylphenylboronic acid (2.30 g, 9.0 mmol, 9 equiv.). ¹H NMR (500 MHz, CDCl₃) δ 7.94 (dd, *J* = 7.9, 1.8 Hz, 1H), 7.88 (d, *J* = 14.6 Hz, 2H), 7.77 (d, *J* = 5.8 Hz, 2H), 7.74 (d, *J* = 9.1 Hz, 5H), 7.70 (d, *J* = 2.3 Hz, 1H), 7.62 (s, 1H), 7.29 (d, *J* = 8.7 Hz, 2H), 7.26 (t, *J* = 2.1 Hz, 1H), 7.13 (t, *J* = 7.7 Hz, 1H), 6.70 – 6.67 (m, 1H). ¹³C NMR (101 MHz, CDCl₃) δ 164.4, 160.7, 144.5, 143.6, 140.1, 138.6, 137.3, 132.6, 132.6, 132.0, 131.9, 131.6, 131.6, 131.3, 131.3, 131.0, 131.0, 130.9 (q, *J* = 33.3 Hz, F-C), 130.4, 130.3, 129.5, 129.5, 128.7, 126.8, 124.9, 124.8 (q, *J* = 3.0 Hz, F-C), 123.1 (q, *J* = 273.7 Hz, F-C), 123.0 (q, *J* = 4.0 Hz, F-C), 122.6 (q, *J* = 4.0 Hz, F-C), 122.1

(q, J = 4.0 Hz, F-C), 121.5, 120.1, 117.9, 108.8. HRMS (APCI) Calcd. For $C_{36}H_{17}B_2F_{18}N_3O_2$ [M]⁺: 886.1256, found 886.1221.

Synthesis of BOPSH 1f: BOPSH 1f was prepared and purified (silica gel, hexane/CH₂Cl₂ = 3/1, v/v) as a light-yellow powder (515 mg) in 82% yield from pyrrole-2-carbaldehyde (95 mg, 1 mmol), salicylhydrazide (168 mg, 1.1 mmol) and 2-naphthylboronic acid (1.55 g, 9.0 mmol, 9 equiv.). ¹H NMR (500 MHz, CDCl₃) δ 7.94 – 7.92 (m, 3H), 7.85 (dd, *J* = 13.4, 8.2 Hz, 4H), 7.79 – 7.77 (m, 2H), 7.72 (dt, *J* = 2.1, 1.0 Hz, 1H), 7.68 (dd, *J* = 8.2, 1.2 Hz, 1H), 7.62 – 7.58 (m, 3H), 7.52 (dd, *J* = 8.2, 4.6 Hz, 2H), 7.49 – 7.43 (m, 3H), 7.39 – 7.36 (m, 2H), 7.31 (s, 1H), 7.31 – 7.24 (m, 1H), 7.24 (s, 1H), 7.14 (td, *J* = 7.6, 7.0, 1.1 Hz, 1H), 7.00 – 6.97 (m, 3H), 6.53 (dd, *J* = 3.9, 2.1 Hz, 1H). ¹³C NMR (126 MHz, CDCl₃) δ 164.3, 161.1, 138.5, 138.2, 135.0, 133.7, 133.5, 133.4, 133.2, 133.2, 133.0, 132.8, 131.0, 130.1, 129.8, 129.6, 128.5, 128.2, 128.2, 128.0, 127.9, 127.6, 127.6, 127.4, 127.3, 127.2, 127.0, 126.0, 125.8, 125.7, 125.6, 125.4, 125.3, 124.9, 123.9, 120.3, 120.1, 116.0, 110.3. ¹¹B NMR (128 MHz, CDCl₃) δ 4.28 (brs), -2.26 (brs). HRMS (APCI) Calcd. For C₄₂H₃₀B₂N₃O₂ [M + H]⁺: 630.2524, found 630.2539.

Synthesis of BOPSH 1g: BOPSH 1g was prepared and purified (silica gel, hexane/CH₂Cl₂ = 2.5/1, v/v) as a light-red powder (385 mg) in 65% yield from pyrrole-2-carbaldehyde (95 mg, 1 mmol), salicylhydrazide (56 mg, 0.3 mmol) and 9,9'-spirobi[fluoren]-2-ylboronic acid (1.0 g, 3.0 mmol, 9 equiv.). ¹H NMR (400 MHz, CDCl₃) δ 7.86 – 7.77 (m, 6H), 7.72 (dt, *J* = 13.6, 7.2 Hz, 4H), 7.62 (dd, *J* = 9.9, 7.6 Hz, 2H), 7.46 (dd, *J* = 7.8, 1.8 Hz, 1H), 7.38 – 7.25 (m, 9H), 7.18 – 7.14 (m, 3H), 7.12 – 7.05 (m, 3H), 7.04 – 6.93 (m, 6H), 6.89 – 6.85 (m, 2H), 6.76 – 6.70 (m, 3H), 6.65 – 6.57 (m, 11H), 6.47 (dd, *J* = 7.6, 1.2 Hz, 1H), 6.35 (d, *J* = 7.6 Hz, 1H), 6.23 (dd, *J* = 3.9, 2.1 Hz, 1H). ¹³C NMR (126 MHz, CDCl₃) δ 163.7, 160.4, 156.9, 154.4, 149.5, 149.3, 149.2, 149.0, 148.9, 148.8, 148.1, 147.7, 147.7, 142.1, 141.9, 141.8, 141.8, 141.7, 141.6, 141.5, 140.8, 137.7, 134.7, 133.6, 132.4, 131.0, 129.8, 129.7, 128.6, 128.2, 127.8, 127.8, 127.8, 127.8, 127.6, 127.6, 127.5, 127.5, 127.4, 127.4, 127.3, 127.2, 126.8, 125.7, 124.2, 124.0, 124.0, 124.0, 123.9, 123.9, 123.8, 123.4, 120.0, 120.0, 119.9, 119.9, 119.7, 119.5, 119.3, 119.2, 115.6, 110.5, 66.2, 65.9, 65.8. HRMS (APCI) Calcd. For C₈₇H₅₃B₂N₃O₂ [M]⁺: 1194.4357, found 1194.4351.

Synthesis of BOPSH 1h: BOPSH 1h was prepared and purified (silica gel, hexane/CH₂Cl₂ = 3.5/1, v/v) as a light-yellow powder (425 mg) in 84% yield from 3,5-dimethyl-1H-pyrrole-2-carbaldehyde (123 mg, 1 mmol), salicylhydrazide (168 mg, 1.1 mmol) and phenylboronic acid (1.10 g, 9.0 mmol, 9 equiv.). ¹H NMR (400 MHz, CDCl₃) δ 7.79 (dd, *J* = 7.8, 1.7 Hz, 1H), 7.57 (ddd, *J* = 8.7, 7.4, 1.7 Hz, 1H), 7.51 (s, 1H), 7.44 – 7.42 (m, 2H), 7.40 (dd, *J* = 6.5, 3.0 Hz, 2H), 7.34 – 7.31 (m, 3H), 7.25 (d, *J* = 3.5 Hz, 3H), 7.21 (d, *J* = 8.4 Hz, 1H), 7.10 – 7.04 (m, 5H), 6.94 (td, *J* = 7.6, 1.0 Hz, 1H), 6.05 (s, 1H), 2.41 (s, 3H),

2.21 (s, 3H). ¹³C NMR (101 MHz, CDCl₃) δ 162.8, 160.7, 149.2, 143.8, 137.6, 137.1, 133.8, 133.0, 131.8, 130.6, 128.3, 127.8, 127.5, 127.4, 127.4, 127.3, 123.7, 119.9, 119.8, 117.4, 110.5, 14.6, 11.1. ¹¹B NMR (128 MHz, CDCl₃) δ 11.20 (brs), 4.11 (brs). HRMS (APCI) Calcd. For C₃₂H₂₈B₂N₃O₂ [M + H]⁺: 508.2368, found 508.2367.

Synthesis of BOPSH 1i: BOPSH 1i was prepared and purified (silica gel, hexane/CH₂Cl₂ = 3.5/1, v/v) as a light-yellow powder (427 mg) in 80% yield from 3,5-dimethyl-4-ethyl-1H-pyrrole-2-carbaldehyde (154 mg, 1 mmol), salicylhydrazide (168 mg, 1.1 mmol) and phenylboronic acid (1.10 g, 9.0 mmol, 9 equiv.). ¹H NMR (500 MHz, CDCl₃) δ 7.78 (dt, J = 7.8, 1.8 Hz, 1H), 7.56 (tdd, J = 7.3, 1.8, 0.9 Hz, 1H), 7.47 (dd, J = 2.8, 1.5 Hz, 1H), 7.41 (td, J = 6.7, 3.9 Hz, 4H), 7.32 – 7.31 (m, 3H), 7.26 – 7.25 (m, 3H), 7.21 (d, J = 8.5 Hz, 1H), 7.10 – 7.04 (m, 5H), 6.93 (t, J = 7.6 Hz, 1H), 2.37 (dd, J = 18.8, 2.5 Hz, 5H), 2.14 (d, J = 1.3 Hz, 3H), 1.02 (td, J = 7.4, 1.9 Hz, 3H). ¹³C NMR (101 MHz, CDCl₃) δ 162.6, 160.6, 147.7, 137.5, 133.9, 133.3, 133.1, 131.8, 130.7, 130.4, 129.0, 128.2, 128.2, 127.8, 127.7, 127.5, 127.4, 127.3, 125.3, 123.0, 119.9, 119.8, 110.7, 17.3, 14.8, 12.6, 9.3. ¹¹B NMR (128 MHz, CDCl₃) δ 10.48 (brs), 3.82 (brs). HRMS (APCI) Calcd. For C₃₄H₃₂B₂N₃O₂ [M + H]⁺: 536.2681, found 536.2676.

Synthesis of BOPSH 1j: BOPSH 1j was prepared and purified (silica gel, hexane/CH₂Cl₂ = 2.5/1, v/v) as a red powder (336 mg) in 63% yield from thiophene-substituted isoindole-2-carbaldehyde 3d (226 mg, 1 mmol), salicylhydrazide (168 mg, 1.1 mmol) and phenylboronic acid (1.10 g, 9.0 mmol, 9 equiv.). ¹H NMR (500 MHz, CDCl₃) δ 7.91 – 7.90 (m, 2H), 7.82 (dd, *J* = 7.8, 1.8 Hz, 1H), 7.74 (dd, *J* = 3.7, 1.2 Hz, 1H), 7.72 (dt, *J* = 8.3, 1.0 Hz, 1H), 7.59 (dd, *J* = 5.1, 1.2 Hz, 1H), 7.55 (ddd, *J* = 8.8, 7.2, 1.8 Hz, 1H), 7.50 – 7.48 (m, 2H), 7.45 – 7.41 (m, 3H), 7.36 – 7.32 (m, 4H), 7.27 – 7.25 (m, 4H), 7.11 (dd, *J* = 8.5, 1.0 Hz, 1H), 7.04 – 7.01 (m, 1H), 6.97 – 6.91 (m, 3H), 6.86– 6.84 (m, 2H). ¹³C NMR (126 MHz, CDCl₃) δ 162.7, 160.2, 144.0, 139.8, 137.5, 134.7, 133.2, 133.1, 131.9, 131.8, 130.8, 130.2, 130.1, 129.0, 129.0, 128.6, 128.2, 128.0, 127.9, 127.6, 127.5, 127.4, 127.3, 127.2, 125.3, 124.6, 123.0, 122.9, 120.2, 119.7, 119.6, 118.1, 117.2, 110.4. ¹¹B NMR (128 MHz, CDCl₃) δ 29.52 (brs), 4.82 (brs). HRMS (APCI) Calcd. For C₃₆H₂₈B₂N₃O₂S [M + H]⁺: 612.2088, found 612.2106.

Synthesis of BOPSH 1k: BOPSH 1k was prepared and purified (silica gel, hexane/CH₂Cl₂ = 2.5/1, v/v) as a yellow powder (387 mg) in 76% yield from pyrrole-2-carbaldehyde (226 mg, 1 mmol), 4-chlorosalicylhydrazide (205 mg, 1.1 mmol) and phenylboronic acid (1.10 g, 9.0 mmol, 9 equiv.). ¹H NMR (500 MHz, CDCl₃) δ 7.80 (d, *J* = 2.7 Hz, 1H), 7.70 (s, 1H), 7.59 (d, *J* = 1.9 Hz, 1H), 7.51 (dd, *J* = 8.9, 2.7 Hz, 1H), 7.41 (h, *J* = 3.0, 2.6 Hz, 4H), 7.34 (q, *J* = 2.7 Hz, 3H), 7.30 (dd, *J* = 5.0, 1.9 Hz, 3H), 7.15 (d, *J* = 9.0 Hz, 1H), 7.12 – 7.09 (m, 1H), 7.05 (t, *J* = 7.2 Hz, 2H), 7.03 – 7.00 (m, 3H), 6.51 (dd, *J* = 4.0,

2.1 Hz, 1H). ¹³C NMR (126 MHz, CDCl₃) δ 163.1, 159.5, 138.2, 138.2, 135.2, 133.0, 131.5, 130.2, 128.2, 127.9, 127.8, 127.7, 127.6, 127.5, 125.2, 124.8, 124.0, 121.6, 116.1, 111.2. ¹¹B NMR (128 MHz, CDCl₃) δ 12.44, 4.39. HRMS (APCI) Calcd. For C₃₀H₂₃B₂ClN₃O₂ [M]⁺: 513.1701, found 513.1718.

Synthesis of BPSH: To pyrrole-2-carbaldehyde (95 mg, 1.0 mmol) and salicylhydrazide (167 mg, 1.1 mmol) in 20 mL chlorobenzene was added 5 drops of glacial acetic acid slowly. The reaction mixture was refluxed at 110 °C oil bath for 6 h, and TLC was used to follow the reaction. After pyrrole-2-carboxaldehyde derivative disappeared on TLC, K_3PO_4 (690 mg, 3.0 mmol, 3 equiv.) and phenylboronic acid (121 mg, 1.0 mmol, 1 equiv.) were added into the mixture, respectively. After completion of the reaction, the reaction mixture was poured into water (150 mL), and then extracted with CH_2Cl_2 (3×60 mL). The organic layers were combined, dried over anhydrous Na₂SO₄, filtered and evaporated under vacuum. The crude product was purified by silica gel column chromatography and the yellow powder BPSH (289 mg, 92%) was obtained by recrystallization from ethyl acetate and petroleum ether. ¹H NMR (500 MHz, Acetone- d_6) δ 8.01 (s, 1H), 7.88 (d, J = 8.9 Hz, 1H), 7.39 (t, J = 8.5 Hz, 1H), 7.27 (s, 1H), 7.14 (d, J = 6.6 Hz, 2H), 6.99 – 6.94 (m, 4H), 6.84 (t, J = 7.5 Hz, 1H), 6.56 (s, 1H), 6.24 (t, J = 2.5 Hz, 1H). ¹³C NMR (126 MHz, Acetone- d_6) δ 166.3, 160.6, 143.7, 143.0, 135.0, 131.6, 129.2, 127.6, 127.1, 126.8, 119.6, 119.5, 119.2, 114.8, 112.1. HRMS (APCI) Calcd. For C₁₈H₁₅BN₃O₂ [M + H]⁺: 316.1257, found 316.1267.

Synthesis of BOPSH 2a: To salicylhydrazide (167 mg, 1.1 mmol) and pyrrole-2-carbaldehyde (95 mg, 1.0 mmol) in 20 mL chlorobenzene was added 5 drops of glacial acetic acid slowly. The reaction mixture was refluxed at 110 °C oil bath for 6 h, and TLC was used to follow the reaction. After pyrrole-2-carboxaldehyde derivative disappeared on TLC, K₃PO₄ (690 mg, 3.0 mmol, 3 equiv.) and phenylboronic acid (121 mg, 1.0 mmol, 1 equiv.) were added into the mixture, respectively. The reaction was then left stirring in a sealed tube at 100 °C oil bath for 10 h, then 4-tert-butylphenylboronic acid (890 mg, 5.0 mmol, 5 equiv.) was added and reflux at 140 ° C for 10 h. After completion of the reaction, the reaction mixture was poured into water (150 mL), and then extracted with CH₂Cl₂(3×60 mL). The organic layers were combined, dried over anhydrous Na₂SO₄, filtered and evaporated under vacuum. The crude product was purified by silica gel column chromatography and the yellow powder **2a** (366 mg, 62%) was obtained by recrystallization from dichloromethane and petroleum ether. ¹H NMR (500 MHz, CDCl₃) δ 7.83 (dd, J = 7.8, 1.7 Hz, 1H), 7.72 (s, 1H), 7.60 – 7.57 (m, 2H), 7.40 – 7.35 (m, 6H), 7.31 (d, J = 8.2 Hz, 2H), 7.20 (d, J = 8.3 Hz, 1H), 7.08 (td, J = 6.2, 2.4 Hz, 1H), 7.05 – 7.00 (m, 4H), 6.98 – 6.94 (m, 2H), 6.49 (dd, J = 3.9, 2.2 Hz, 1H), 1.32 – 1.31 (m, 18H). ¹³C NMR (126 MHz, CDCl₃) δ 164.0, 163.4, 161.1, 150.9, 150.3, 138.2, 137.7, 134.4, 133.1, 131.5, 130.3, 128.5, 127.4, 124.8, 124.8, 124.5, 123.2, 121.9, 120.1, 120.0,

115.6, 110.4, 34.5, 31.3. ¹¹B NMR (160 MHz, CDCl₃) δ 4.57, 0.65. HRMS (APCI) Calcd. For C₃₈H₄₀B₂N₃O₂ [M + H]⁺: 592.3307, found 592.3316.

Synthesis of BOPSH 2b: To salicylhydrazide (167 mg, 1.1 mmol) and pyrrole-2-carbaldehyde (95 mg, 1.0 mmol) in 20 mL chlorobenzene was added 5 drops of glacial acetic acid slowly. The reaction mixture was refluxed at 110 °C oil bath for 6 h. After pyrrole-2-carboxaldehyde derivative disappeared on TLC, K₃PO₄ (690 mg, 3.0 mmol, 3 equiv.) and phenylboronic acid (121 mg, 1.0 mmol, 1 equiv.) were added into the mixture, respectively. The reaction was then left stirring in a sealed tube at 100 °C oil bath for 10 h, then 4-tert-trifluoromethylbenzeneboronic acid (950 mg, 5.0 mmol, 5 equiv.) was added and reflux at 140 ° C for 10 h. After completion of the reaction, the reaction mixture was poured into water (150 mL), and then extracted with CH_2Cl_2 (3 × 60 mL). The organic layers were combined, dried over anhydrous Na₂SO₄, filtered and evaporated under vacuum. The crude product was purified by silica gel column chromatography and the yellow powder 2b (438 mg, 71%) was obtained by recrystallization from dichloromethane and petroleum ether. ¹H NMR (400 MHz, CDCl₃) δ 7.83 (d, J = 7.9 Hz, 1H), 7.65 – 7.58 (m, 5H), 7.50 (q, J = 8.3 Hz, 6H), 7.22 (d, J = 8.5 Hz, 1H), 7.13 (t, J = 6.9 Hz, 1H), 7.08 – 7.04 (m, 3H), 7.02 - 6.98 (m, 3H), 6.56 (dd, J = 3.8, 1.8 Hz, 1H). ¹³C NMR (126 MHz, CDCl₃) δ 164.0, 161.2, 138.9, 138.1, 136.1, 133.2, 133.2, 131.7, 130.4 (q, J = 32.8 Hz, F-C), 131.1, 130.0, 129.8, 128.4, 127.9, 127.7, 125.5, 125.4, 125.0, 124.7 (q, J = 3.8 Hz, F-C), 127.7, 124.5 (q, J = 3.8 Hz, F-C), 124.4 (q, J = 272.2, F-C), 124.3 (q, J = 262.1, F-C), 123.2, 120.4, 120.1, 116.5, 113.2, 109.6. ¹¹B NMR (128 MHz, CDCl₃) δ 10.60 (brs), 4.06 (brs). HRMS (APCI) Calcd. For C₃₂H₂₂B₂F₆N₃O₂ [M + H]⁺: 616.1574, found 616.1594.

Synthesis of BOPSH 2c: To salicylhydrazide (167 mg, 1.1 mmol) and pyrrole-2-carbaldehyde (95 mg, 1.0 mmol) in 20 mL chlorobenzene was added 5 drops of glacial acetic acid slowly. The reaction mixture was refluxed at 110 °C oil bath for 6 h, and TLC was used to follow the reaction. After pyrrole-2-carboxaldehyde derivative disappeared on TLC, K_3PO_4 (690 mg, 3.0 mmol, 3 equiv.) and phenylboronic acid (121 mg, 1.0 mmol, 1 equiv.) were added into the mixture, respectively. The reaction was then left stirring in a sealed tube at 100 °C oil bath for 10 h, then triethylamine (1.4 mL, 10 equiv.) and boron trifluoride diethyl etherate (2.2 mL, 10 equiv.) was added and reflux at 100 °C for 2 h. After completion of the reaction, the reaction mixture was poured into water (150 mL), and then extracted with CH_2Cl_2 (3 × 60 mL). The organic layers were combined, dried over anhydrous Na₂SO₄, filtered and evaporated under vacuum. The crude product was purified by silica gel column chromatography and the yellow powder **2c** (99 mg, 54%) was obtained by recrystallization from dichloromethane and petroleum ether. ¹H NMR (400 MHz, CDCl₃) δ 7.94 (s, 1H), 7.75 – 7.73 (m, 1H), 7.70 (s, 1H), 7.62 (ddd, *J* = 8.9, 7.2, 1.7 Hz, 1H), 7.20

-7.16 (m, 4H), 7.13 -7.11 (m, 2H), 6.99 (t, *J* = 7.2 Hz, 1H), 6.62 (dd, *J* = 4.2, 2.1 Hz, 1H). ¹³C NMR (101 MHz, CDCl₃) δ 162.6 (d, *J* = 3.0 Hz, F-C), 160.7, 138.9, 138.6, 138.5, 130.1, 128.4, 128.0, 127.8, 127.4, 125.0, 120.6, 120.0, 117.6, 109.2. ¹¹B NMR (128 MHz, CDCl₃) δ 4.02 (brs). ¹⁹F NMR (377 MHz, CDCl₃) δ -142.28 -142.44 (m), -150.00 -150.16 (m). HRMS (APCI) Calcd. For C₁₈H₁₄B₂FN₃O₂ [M - F]⁺: 344.1178, found 344.1210.

Synthesis of BOPSH 2d: To salicylhydrazide (167 mg, 1.1 mmol) and 2,4-dimethyl-3-ethylpyrrole-2carbaldehyde (151 mg, 1.0 mmol) in 20 mL chlorobenzene was added 5 drops of glacial acetic acid slowly. The reaction mixture was refluxed at 110 °C oil bath for 6 h, and TLC was used to follow the reaction. After pyrrole-2-carboxaldehyde derivative disappeared on TLC, K₃PO₄ (690 mg, 3.0 mmol, 3 equiv.) and phenylboronic acid (121 mg, 1.0 mmol, 1 equiv.) were added into the mixture, respectively. The reaction was then left stirring in a sealed tube at 100 °C oil bath for 10 h, then triethylamine (1.4 mL, 10 equiv.) and boron trifluoride diethyl etherate (2.2 mL, 10 equiv.) was added and reflux at 100 ° C for 2 h. After completion of the reaction, the reaction mixture was poured into water (150 mL), and then extracted with CH_2Cl_2 (3 × 60 mL). The organic layers were combined, dried over anhydrous Na₂SO₄, filtered and evaporated under vacuum. The crude product was purified by silica gel column chromatography and the yellow powder 2d (210 mg, 50%) was obtained by recrystallization from dichloromethane and petroleum ether. ¹H NMR (500 MHz, CDCl₃) δ 7.71 – 7.68 (m, 2H), 7.60 – 7.57 (m, 1H), 7.21 – 7.19 (m, 1H), 7.16 -7.14 (m, 3H), 7.10 (dd, J = 6.4, 3.3 Hz, 2H), 6.99 - 6.93 (m, 1H), 2.45 - 2.38 (m, 5H), 2.27 (s, 3H), 1.05 (t, J = 7.6 Hz, 3H). ¹³C NMR (126 MHz, CDCl₃) δ 160.5 (d, J = 2.5 Hz, F-C), 160.0, 156.0, 153.2, 137.8, 137.6, 137.6, 132.9, 132.5, 130.5, 127.9, 127.7, 124.0, 120.3, 119.7, 109.8, 17.3, 14.5, 12.9, 9.3. ¹¹B NMR (128 MHz, CDCl₃) δ 4.04 (brs). ¹⁹F NMR (471 MHz, CDCl₃) δ -142.07--142.24 (m), -149.12 - - 149.27 (m). HRMS (APCI) Calcd. For C₂₂H₂₂B₂F₂N₃O₂ [M + H]⁺: 420.1866, found 420.1840.

Synthesis of BOPSH 2e: To salicylhydrazide (167 mg, 1.1 mmol) and pyrrole-2-carbaldehyde (151 mg, 1.0 mmol) in 20 mL chlorobenzene was added 5 drops of glacial acetic acid slowly. The reaction mixture was refluxed at 110 °C oil bath for 6 h, and TLC was used to follow the reaction. After pyrrole-2-carboxaldehyde derivative disappeared on TLC, K_3PO_4 (690 mg, 3.0 mmol, 3 equiv.) and 1,4-phenylenebisboronic acid (82 mg, 0.5 mmol, 0.5 equiv.) were added into the intermediate from the ligand. After the intermediate disappeared on TLC, K_3PO_4 (1.38 g, 6.0 mmol, 6 equiv.) and phenylboronic acid (2.18 g, 18 mmol, 18 equiv.) was added and reflux at 140 °C for 10 h. Then, the reaction mixture was poured into water (150 mL), and then extracted with CH_2Cl_2 (3 × 60 mL). The organic layers were combined, dried over anhydrous Na₂SO₄, filtered and evaporated under vacuum. The crude product was

purified by silica gel column chromatography and the yellow powder **2e** (243 mg, 45%) was obtained by recrystallization from dichloromethane and petroleum ether. ¹H NMR (400 MHz, CDCl₃) δ 7.80 (dd, *J* = 7.8, 1.7 Hz, 2H), 7.60 – 7.55 (m, 4H), 7.52 – 7.50 (m, 2H), 7.41 – 7.37 (m, 4H), 7.32 – 7.30 (m, 6H), 7.24 (d, *J* = 1.4 Hz, 2H), 7.22 (d, *J* = 1.4 Hz, 2H), 7.17 – 7.11 (m, 4H), 7.05 – 6.97 (m, 4H), 6.96 – 6.92 (m, 4H), 6.70 (d, *J* = 3.3 Hz, 4H), 6.48 – 6.46 (m, 2H). ¹³C NMR (101 MHz, CDCl₃) δ 163.8, 163.2, 163.1, 138.2, 138.0, 137.8, 134.8, 134.8, 132.9, 131.8, 131.8, 129.5, 129.4, 128.4, 128.4, 128.0, 127.9, 127.5, 127.4, 127.4, 125.0, 123.3, 123.2, 119.9, 115.6, 115.6, 110.1, 110.1. ¹¹B NMR (128 MHz, CDCl₃) δ 6.8 (brs). HRMS (APCI) Calcd. For C₅₄H₄₀B₄N₆O₄ [M]⁺: 880.3483, found 880.3503.

3. Crystal diagrams and selected parameters

3.1 Crystal diagrams



Figure S1. Front view (a), top view (b) and crystal-packing pattern (c) of the crystal structure for BOPSH **1a**. The interlayer distance is 7.52 Å. Slip angel of 43.2° for coplanar inclined arrangements of its transition dipole. C, gray; N, blue; O, red; B, yellow; H atoms are omitted for clarity.



Figure S2. Front view (a), top view (b) and crystal-packing pattern (c) of the crystal structure for BOPSH **1d**. The interlayer distance is 10.32 Å. Slip angel of 40.5° for coplanar inclined arrangements of its transition dipole. C, gray; N, blue; O, red; B, yellow; H atoms are omitted for clarity.



Figure S3. Front view (a), top view (b) and crystal-packing pattern (c) of the crystal structure for BOPSH **1h**. The interlayer distance is 7.41 Å. Slip angel of 50.1° for coplanar inclined arrangements of its transition dipole. C, gray; N, blue; O, red; B, yellow; H atoms are omitted for clarity.



Figure S4. Front view (a), top view (b) and crystal-packing pattern (c) of the crystal structure for BOPSH **1i**. The interlayer distance is 3.33 Å. Slip angel of 20.3° for coplanar inclined arrangements of its transition dipole. C, gray; N, blue; O, red; B, yellow; H atoms are omitted for clarity.



Figure S5. Front view (a), top view (b) and crystal-packing pattern (c) of the crystal structure for BOPSH **1j**. The interlayer distance is 3.84 Å. Slip angel of 23.3° for coplanar inclined arrangements of its transition dipole. C, gray; N, blue; O, red; B, yellow; S, light yellow; H atoms are omitted for clarity.



Figure S6. Front view (a), top view (b) and crystal-packing pattern (c) of the crystal structure for BOPSH **1k**. The interlayer distance is 5.13 Å. Slip angel of 29.7° for coplanar inclined arrangements of its transition dipole. C, gray; N, blue; O, red; B, yellow; H atoms are omitted for clarity.



Figure S7. Front view (a), top view (b) and crystal-packing pattern (c) of the crystal structure for BOPSH **2e.** The interlayer distance is 7.41 Å. Slip angel of 31.4° for coplanar inclined arrangements of its transition dipole. C, gray; N, blue; O, red; B, yellow; H atoms are omitted for clarity.

3.2 Tetrahedral Character (THCDA) ^[9]



Figure S8. Tetrahedral Character of the two boron atoms in BOPSH 1a.

The six bond angles $\theta_1 - \theta_6$ (°) at the B1 atom:

N1-B1-N2: 102.39 N1-B1-O1: 105.7 N1-B1-C2: 111.94 C2-B1-N2: 112.52 C2-B1-O1: 112.74 O1-B1-N2: 110.89

Tetrahedral Character of the B1 atoms in BOPSH 1a according to the Höpfl's equivuation:

THC_{DA, B1} =
$$\left[1 - \frac{\sum_{n=1-6}^{n} |109.5 - \theta_n|^{\circ}}{90^{\circ}}\right] \times 100\% = 76.7\%$$

The six bond angles $\theta_1 - \theta_6$ (°) at the B2 atom:

N3-B2-O2: 95.12 N3-B2-C3: 112.28 N3-B2-C4: 111.13 C3-B2-C4: 115.93 O2-B2-C3: 111.79 O2-B2-C4: 108.66

Tetrahedral Character of the B2 atoms in BOPSH 1a acoording to the Höpfl's equivuation:

$$\text{THC}_{DA} = \left[1 - \frac{\sum_{n=1-6}^{n} |109.5 - \theta_n|^{\circ}}{90^{\circ}}\right] \times 100\% = 68.5\%$$

3.3 Selected parameters

Table S1. Crystal data and data collection parameters for 1a, 1e, 1h and 1i obtained from crystallography.

dye	1 a	1e	1h	1i
Empirical formula	$C_{30}H_{23}B_2N_3O_2$	$C_{36}H_{17}B_2F_{18}N_3O_2$	$C_{32}H_{27}B_2N_3O_2$	$C_{34}H_{31}B_2N_3O_2$
Formula weight	479.13	887.15	507.24	535.24
Temperature/K	293(2)	298	293(2)	293
Crystal system	triclinic	monoclinic	triclinic	monoclinic
Space group	P-1	P21/n	P-1	P21
a/Å	9.9773(4)	15.472(2)	9.6663(7)	9.5820(5)
b/Å	10.9806(5)	16.178(2)	10.0753(8)	43.689(2)
c/Å	13.4862(5)	15.892(2)	14.4164(13)	15.6237(8)
α/°	74.857(2)	90	92.413(3)	90
β/°	79.474(2)	109.432(7)	101.539(3)	90.164(3)
γ/°	63.421(2)	90	93.307(3)	90
Volume/Å ³	1271.77(9)	3751.2(9)	1371.29(19)	6540.6(6)
Z	2	4	2	8
$\rho_{calc}g/cm^3$	1.251	1.571	1.2283	1.087
μ/mm ⁻¹	0.078	1.431	0.076	0.524
F(000)	500	1768	532.2	2256
Crystal size/mm ³	0.16 imes 0.14 imes	0.24 imes 0.13 imes	0.14 imes 0.12 imes	0.17 imes 0.12 imes
	$\frac{0.09}{M_{\odot}K_{\odot}} =$	0.12	0.11	$\frac{0.1}{C_{\rm PV}K_{\rm PV}(\lambda)} =$
Radiation	0.71073	1.54178	0.71073	1.54178
2Θ range for data collection/°	6.278 to 52	10.938 to 132	5.66 to 50	5.656 to 144.584
Index ranges	$-12 \le h \le 12,$ $-13 \le k \le 13,$ $-16 \le 1 \le 16$	$-18 \le h \le 18,$ $-19 \le k \le 19,$ $-18 \le 1 \le 18$	$-12 \le h \le 12,$ $-13 \le k \le 13,$ $-18 \le 1 \le 18$	$-11 \le h \le 11,$ $-53 \le k \le 53,$ $-19 \le 1 \le 16$
Reflections collected	75769	35612	26740	109854
Independent reflections	$\begin{array}{l} 4986 \; [R_{int} = \\ 0.0496, \; R_{sigma} = \\ 0.0156] \end{array}$	$6357 [R_{int} = 0.1146, R_{sigma} = 0.0952]$	$\begin{array}{l} 4767 \; [R_{int} = \\ 0.0503, \\ R_{sigma} = \\ 0.0484] \end{array}$	$25164 [R_{int} = 0.0841, R_{sigma} = 0.0531]$
Data/restraints/pa rameters	4986/0/334	6357/3/719	4767/0/354	25164/690/144 3
Goodness-of-fit on F ²	1.093	1.019	1.232	1.024
Final R indexes $[I \ge 2\sigma (I)]$	$R_1 = 0.0518,$ $wR_2 = 0.1232$	$R_1 = 0.0736,$ $wR_2 = 0.2036$	$R_1 = 0.0843,$ $wR_2 = 0.1843$	$R_1 = 0.0743,$ $wR_2 = 0.2013$
Final R indexes	$R_1 = 0.0673,$	$R_1 = 0.1306,$	$R_1 = 0.1094,$	$R_1 = 0.0817,$
[all data]	$wR_2 = 0.1338$	$wR_2 = 0.2288$	$wR_2 = 0.2134$	$wR_2 = 0.2108$
Largest diff. peak/hole / $e^{\text{Å}^{-3}}$	0.25/-0.24	0.38/-0.32	0.28/-0.31	0.33/-0.32

Table S2.	Crystal	data ar	nd data (collection	n paramet	ers for	BOPSHs	5 1 j,	1k and 2	2e obtain	ned from
crystallogi	raphy.										

dye	1j	1k	2e	
Empirical formula	$C_{38}H_{27}B_2N_3O_2S$	C ₃₀ H ₂₂ B ₂ ClN ₃ O ₂	$C_{54}H_{40}B_4N_6O_4$	
Formula weight	611.38	513.57	880.16	
Temperature/K	300	298	300	
Crystal system	monoclinic	triclinic	triclinic	
Space group	C2/c	P-1	P-1	
a/Å	29.2198(9)	10.3708(6)	15.483(5)	
b/Å	9.7169(3)	11.0431(6)	16.607(5)	
c/Å	23.8263(7)	11.9274(6)	18.455(5)	
α/°	90	86.785(4)	63.503(19)	
β/°	104.397(3)	74.699(4)	76.50(2)	
γ/°	90	74.116(4)	65.205(19)	
Volume/Å ³	6552.5(4)	1267.07(12)	3849(2)	
Z	8	2	3	
$\rho_{calc}g/cm^3$	1.24	1.346	1.139	
µ/mm⁻¹	1.175	1.604	0.569	
F(000)	2544	532	1374	
Crystal size/mm ³	$0.16 \times 0.12 \times 0.1$	$0.2 \times 0.16 \times 0.12$	$0.23 \times 0.11 \times 0.08$	
Radiation	CuKα (λ = 1.54178)	CuKα (λ = 1.5417)	CuKα (λ = 1.54178)	
2⊖ range for data collection/°	6.246 to 149.436	7.686 to 131.996	5.36 to 131.986	
Index ranges	$\begin{array}{c} -36 \leq h \leq 36, -12 \\ \leq k \leq 11, -29 \leq 1 \\ \leq 29 \end{array}$	$-12 \le h \le 12, -13$ $\le k \le 13, -14 \le 1 \le$ 14	$\begin{array}{l} -18 \leq h \leq 18, 19 \leq \\ k \leq 19, 21 \leq 1 \leq 21 \end{array}$	
Reflections collected	63588	13260	40602	
Independent reflections	6707 [R _{int} = 0.0490, R _{sigma} = 0.0222]	$\begin{array}{l} 4203 \; [R_{in}t = \\ 0.0521, \\ R_{sigma} = 0.0557] \end{array}$	$13072 [R_{int} = 0.0785, R_{sigma} = 0.0936]$	
Data/restraints/parameter	6707/13/429	4203/0/343	13072/138/823	
Goodness-of-fit on F ²	1.046	0.953	0.868	
Final R indexes [I>=2σ (I)]	$\begin{array}{c} R_1 = 0.0419, \\ wR_2 = 0.1182 \end{array}$	$\begin{array}{c} R_1 = 0.0454, \\ wR_2 = 0.1109 \end{array}$	$R_1 = 0.0838, \\ wR_2 = 0.2243$	
Final R indexes [all data]	$\begin{array}{c} R_1 = 0.0523, \\ wR_2 = 0.1257 \end{array}$	$\begin{array}{c} R_1 = 0.0690, \\ wR_2 = 0.1204 \end{array}$	$\begin{array}{c} R_1 = 0.1969, \\ wR_2 = 0.2720 \end{array}$	
Largest diff. peak/hole / e Å ⁻³	0.35/-0.30	0.21/-0.24	0.38/-0.34	

Table S3. Selected bond lengths [Å] and dihedral angles [deg] of BOPSHs **1a**, **1d**, **1h** and **1i** obtained from crystallography.

	F ₃ C G A B C C F ₃ C C F ₃ C C C F ₃ C C C F ₃ C C C C C C C C C C C C C C C C C C C	CF ₃ CF ₃ CF ₃ A B CF ₃ CF	H A B N B D	B
F O F F ₃ C-	F E E CF ₃ 1e	F D E Ih	F O I	
dyes	1 a	1e	1h	1i
N-N bond distances (Å)	1.392(17)	1.371(35)	1.396(33)	1.385(63)
B-N bond distances (Å)	1.546(24), 1.572(26), 1.597(26)	1.564(49), 1.565(34), 1.585(44)	1.549(47), 1.570(37), 1.595(37)	1.543(75), 1.582(71), 1.605(75)
B-O bond distances (Å)	1.464(21), 1.574(22)	1.453(48), 1.575(57)	1.467(41), 1.579(41)	1.486(68), 1.565(71)
Distance between the two boron atoms (Å)	3.935(28)	3.928(43)	3.944(44)	3.969(83)
dihedral angles between pyrrolic ring A and the newly formed six- membered N ₃ C ₂ B ring B (deg)	4.685(64)	5.983 (93)	6.06(116)	4.011(169)
dihedral angles between pyrrolic ring A and the newly formed five- membered N ₂ CBO ring C (deg)	25.433(68)	13.406 (107)	31.426(129)	22.842(169)
dihedral angles between pyrrolic ring A and the newly formed six- membered NC ₃ BO ring D (deg)	30.638(69)	16.007 (110)	32.402(110)	31.013(181)
dihedral angles between the pyrrolic ring A and the phenyl ring E (deg)	24.708(66)	7.221 (118)	26.289(122)	27.732(188)
dihedral angles between the pyrrolic ring A and the phenyl ring F/G/H (deg)	81.491(84), 76.150(75), 61.652(71)	82.962(102), 67.982(104), 87.898(112)	76.615(141), 60.722(140), 87.768(140)	82.660(198), 84.173(221), 80.260(222)
dihedral angles between the N ₃ C ₂ B ring B and phenyl ring F (deg)	86.118(71)	79.027(85)	82.673(113)	86.321(171)
dihedral angles between the two phenyl rings G and H on the same boron atom (deg)	77.323(68)	86.227(107)	83.454(133)	80.278(254)

 Table S4. Selected bond lengths [Å] and dihedral angles [deg] of BOPSHs 1j, 1k and 2e obtained from crystallography.

G G H H A N B N C O E S E	F N B N C O E		E O F N O B N N B · ·
1j	1k Cl	2	
dyes	1j	1k	2e
N-N bond distances (Å)	1.399(15)	1.395(2)	1.388(4), 1.413(4)
B-N bond distances (Å)	1.559(19), 1.576(22), 1.597(20)	1.545(3), 1.567(3), 1.605(3)	1.533(5), 1.545(6), 1.555(5), 1.570(5), 1.585(7), 1.615(5)
D. O. hand distances (Å)	1.453(17),	1.480(3),	1.482(5), 1.454(5)
B-O bond distances (A)	1.575(17)	1.589(3)	1.571(6), 1.622(6)
Distance between the two boron atoms (Å)	3.902(22)	3.933(48)	3.960(67), 6.078(96)
dihedral angles between pyrrolic ring A and the newly formed six- membered N ₃ C ₂ B ring B (deg)	4.327(40)	7.725(60)	2.669(223), 3.534(159)
dihedral angles between pyrrolic ring A and the newly formed five- membered N ₂ CBO ring C (deg)	31.181(45)	27.812(83)	7.180(175), 15.514(177)
dihedral angles between pyrrolic ring A and the newly formed six- membered NC ₃ BO ring D (deg)	35.383(43)	31.149(80)	15.851(213), 17.804(140)
dihedral angles between the pyrrolic ring A and the phenyl ring E (deg)	33.290(51)	28.992(87)	14.269(257), 9.460(148)
dihedral angles between the pyrrolic	88.066(49),	81.066(85)	78.229(192), 89.368(172)
ring A and the phenyl ring F/G/H	65.728(52),	87.397(90)	70.623(250), 61.246(152)
(deg)	83.550(44)	65.766(96)	73.076(254), 69.801(208)
dihedral angles between the N ₃ C ₂ B ring B and phenyl ring F (deg)	88.525(41)	77.057(79)	76.111(140), 89.061(133)
dihedral angles between the two phenyl rings G and H on the same boron atom (deg)	73.154(53)	66.129(85)	71.207(233), 72.386(203)

4. Spectroscopic data and spectra

dyes	solvents	$\lambda_{abs}^{max}/nm \ (log \epsilon_{max})^a$	λ_{em}^{max} (nm)	ϕ^{b}	Stokes Shift (cm ⁻¹)	τ/ns ^c
	hexane	349 (4.21), 411 (4.11)	456, 484	81%	2400	7.41
	toluene	349 (4.18), 413 (4.11)	464, 489	95%	2700	6.67
	DCM	349 (4.15), 412 (4.08)	464, 489	90%	2700	7.12
1a	THF	345 (4.18), 409 (4.10)	467, 488	87%	3000	6.89
	ACN	342 (4.14), 409 (4.07)	469, 488	79%	3100	7.63
	MeOH	345 (4.13), 407 (4.06)	464, 489	80%	3000	7.46
	hexane	349 (4.03), 411 (3.95)	456, 484	83%	2400	7.60
	toluene	349 (3.98), 414 (3.92)	464, 490	77%	2600	6.46
1h	DCM	347 (4.11), 411 (4.04)	465, 492	73%	2800	7.12
10	THF	346 (4.03), 410 (3.95)	466, 490	77%	2900	7.21
	ACN	344 (4.00), 408 (3.92)	469, 490	71%	3200	7.63
	MeOH	345 (4.01), 409 (3.94)	464, 488	77%	2900	7.55
	hexane	350 (4.15), 413 (4.05)	457, 484	79%	2300	7.27
	toluene	352 (4.09), 414 (4.02)	460, 490	80%	2400	6.60
10	DCM	347 (4.13), 412 (4.05)	464, 489	81%	2700	7.09
ю	THF	348 (4.10), 411 (4.02)	466, 489	75%	2900	7.11
	ACN	345 (4.16), 408 (4.07)	470, 490	75%	3200	7.71
	MeOH	346 (4.09), 409 (4.00)	467, 488	56%	3000	7.64
	hexane	351 (4.19), 412 (4.08)	456, 483	82%	2300	7.11
	toluene	351 (4.15), 414 (4.07)	465, 490	85%	2600	6.41
1d	DCM	350 (4.16), 412 (4.09)	462, 488	77%	2700	6.79
Iu	THF	348 (4.11), 411 (4.04)	465, 489	47%	2900	6.91
	ACN	344 (4.12), 408 (4.04)	466, 483	62%	3100	7.28
	MeOH	344 (4.12), 409 (4.03)	460, 481	52%	2900	7.23
	hexane	353 (4.11), 414 (3.95)	454, 482	74%	2100	6.47
	toluene	356 (4.02), 418 (3.92)	463, 489	73%	2300	5.95
1e	DCM	351 (4.08), 413 (3.92)	460, 486	75%	2500	6.25
н	THF	350 (3.97), 404 (3.95)	461, 486	69%	3100	6.46
	ACN	344 (4.03), 407 (3.92)	462, 483	72%	2900	6.88
	MeOH	349 (4.03), 407 (3.94)	457, 482	51%	2700	6.78
	hexane	338 (4.18), 411 (4.09)	460, 484	87%	2600	7.98
	toluene	341 (4.16), 414 (4.08)	469, 490	90%	2800	7.17
1f	DCM	348 (4.16), 411 (4.09)	467, 489	90%	2900	8.07
11	THF	337 (4.16), 411 (4.07)	467, 489	85%	2900	7.27
	ACN	339 (4.16), 408 (4.07)	471, 488	83%	3300	7.84
	MeOH	342 (4.15), 410 (4.06)	467, 488	78%	3000	7.83

Table S5. Photophysical properties of 1a-k in different solvents.

					*pporting in	ormation
	hexane	340 (4.19), 413 (4.03)	457, 484	80%	2300	8.03
	toluene	342 (4.19), 414 (4.04)	465, 489	71%	2600	7.04
1~	DCM	342 (4.14), 412 (3.97)	466, 489	75%	2800	7.70
Ig	THF	334 (4.20), 410 (4.03)	467, 490	65%	2900	7.70
	ACN	339 (4.16), 409 (3.99)	471, 491	71%	3200	8.27
	MeOH	336 (4.15), 311 (3.99)	466, 487	70%	2900	8.38
	hexane	339 (4.16), 422 (4.23)	470, 498	98%	2400	7.12
	toluene	337 (4.15), 425 (4.22)	477, 506	94%	2600	6.35
	DCM	338 (4.17), 424 (4.23)	480, 507	96%	2800	7.09
111	THF	336 (4.17), 422 (4.22)	479, 506	91%	2800	6.89
	ACN	333 (4.17), 420 (4.21)	485, 507	85%	3200	7.17
	MeOH	333 (4.18), 422 (4.23)	484, 505	83%	3000	7.09
	hexane	336 (4.13), 431 (4.19)	478, 510	0.94	2300	7.13
	toluene	338 (4.13), 435 (4.19)	488, 518	94%	2500	6.37
1:	DCM	332 (4.16), 433 (4.21)	495, 521	97%	2800	6.98
11	THF	331 (4.13), 431 (4.18)	493, 517	80%	2900	6.86
	ACN	325 (4.13), 430 (4.17)	497, 520	70%	3100	6.03
	MeOH	333 (4.13), 431 (4.17)	496, 519	80%	3000	6.04
	hexane	353 (4.05), 491 (4.26)	551	84%	2200	7.00
	toluene	360 (4.09), 495 (4.29)	560	79%	2300	6.03
1;	DCM	357 (4.07), 494 (4.29)	560	77%	2400	6.16
IJ	THF	356 (4.07), 492 (4.28)	559	72%	2400	5.87
	ACN	355 (4.06), 492 (4.28)	559	48%	2400	4.78
	MeOH	354 (4.04), 495 (4.26)	559	44%	2300	4.90
	hexane	355 (4.20), 418 (4.04)	461, 493	57%	2200	7.11
	toluene	360 (4.18), 421 (4.04)	471, 499	65%	2500	6.41
11,	DCM	358 (4.06), 420 (4.06)	474, 502	65%	2700	6.79
IK	THF	356 (4.15), 416 (4.03)	476, 499	64%	3000	6.91
	ACN	355 (4.15), 415 (4.03)	478, 503	60%	3200	7.28
	MeOH	356 (4.12), 416 (4.00)	476, 500	48%	3000	7.23

Electronic Supporting Information

^a Molar absorption coefficients are in the maximum of the corresponding highest peak. ^b Fluorescence quantum yields in different solvents were measured using integrating sphere (excited at 400 nm for **1a-g** and **1k**, excited at 430 nm for **1h** and **1i**, and excited at 490 nm for **1j**). ^c Fluorescence lifetime.

dyes	solvents	$\lambda_{abs}{}^{max}\!/\!nm\;(log\epsilon_{max})^a$	λ_{em}^{max} (nm)	$\boldsymbol{\varphi}^{b}$	Stokes Shift (cm ⁻¹)	τ/ns ^c
	hexane	349 (4.02), 411 (3.92)	458, 481	77%	2500	7.43
	toluene	352 (3.97), 413 (3.90)	463, 487	79%	2600	6.60
2-	DCM	347 (3.98), 411 (3.90)	463, 487	79%	2700	7.28
2 a	THF	346 (3.95), 410 (3.86)	464, 488	75%	2800	7.26
	ACN	343 (3.97), 408 (3.90)	466, 488	72%	3100	7.84
	MeOH	345 (3.98), 409 (3.91)	462, 486	68%	2800	7.83
	hexane	352 (4.21), 415 (4.11)	457, 486	77%	2200	7.14
	toluene	349 (4.12), 413 (4.04)	466, 491	79%	2800	6.50
2h	DCM	349 (4.19), 412 (4.11)	463, 490	77%	2700	6.87
20	THF	345 (4.14), 409 (4.03)	466, 489	77%	3000	6.93
	ACN	342 (4.14), 409 (4.06)	470, 488	75%	3200	7.36
	MeOH	345 (4.20), 407 (4.11)	461, 489	55%	2900	7.43
	hexane	384 (4.13), 416 (4.08)	457, 486	57%	2200	5.91
	toluene	350 (4.02), 419 (3.99)	467, 492	57%	2500	5.63
20	DCM	348 (4.04), 416 (4.01)	468, 490	59%	2700	5.57
20	THF	339 (3.98), 412 (3.95)	462, 487	48%	2600	5.47
	ACN	313 (4.02), 393 (3.99)	468, 487	42%	4100	5.53
	MeOH	318 (3.96), 390 (3.93)	474, 498	50%	4500	3.38
	hexane	340 (4.24), 426 (4.30)	469, 499	71%	2200	6.13
	toluene	342 (4.16), 432 (4.23)	476, 504	71%	2100	5.55
2d	DCM	337 (4.18), 428 (4.23)	476, 506	62%	2400	5.69
2u	THF	341 (4.16), 427 (4.24)	475, 503	58%	2400	5.17
	ACN	336 (4.20), 425 (4.26)	479, 504	52%	2700	5.91
	MeOH	325 (4.17), 408 (4.27)	474, 502	44%	3400	5.55
	hexane	347 (4.43), 413 (4.36)	454, 484	76%	2200	7.83
	toluene	349 (4.42), 414 (4.36)	463, 491	76%	2600	6.94
20	DCM	346 (4.41), 412 (4.34)	465, 491	78%	2800	7.60
40	THF	345 (4.41), 412 (4.33)	464, 491	43%	2700	5.52
	ACN	343 (4.42), 408 (4.35)	464, 491	59%	3000	7.39
	MeOH	342 (4.41), 410 (4.35)	461, 491	71%	2700	8.01

Table S6. Photophysical properties of BOPSHs 2a-e in different solvents.

^a Molar absorption coefficients are in the maximum of the corresponding highest peak. ^b Fluorescence quantum yields in different solvents were measured using integrating sphere (excited at 400 nm for **2a-e**). ^c Fluorescence lifetime.

Electronic Supporting Information

dyes	solvents	$\lambda_{em}^{max} (nm)^a$	ϕ^{b}	τ/ns
	pristine powder state	489	0.80	5.47
1 a	crystal state	512	0.70	5.74
	grinded powders	484	0.84	5.93
	pristine powder state	532	0.56	4.37
1i	crystal state	544	0.45	5.06
	grinded powders	526	0.53	4.42

Table S7. Photophysical properties of BOPSHs 1a and 1i in powder, crystal and grinded solid states.

^a Emission wavelength maximum are in the maximum of the corresponding highest peak. ^b Absolute fluorescence quantum yields in the pristine powder, crystal, and grind states were measured using integrating sphere (excited at 420 nm for **1a**, and 460 nm for **1i**). ^c Fluorescence lifetime.

4.1 Spectroscopic spectra of BOPSHs 1 and 2 in different organic solvents



Figure S9. Normalized absorption (dot line) and fluorescence (solid line) spectra of **1a** in hexane, toluene, dichloromethane, tetrahydrofuran, acetonitrile and methanol, excited at 400 nm.



Figure S10. Normalized absorption (dot line) and fluorescence (solid line) spectra of 1b in hexane, toluene, dichloromethane, tetrahydrofuran, acetonitrile and methanol, excited at 400 nm.



Figure S11. Normalized absorption (dot line) and fluorescence (solid line) spectra of 1c in hexane, toluene, dichloromethane, tetrahydrofuran, acetonitrile and methanol, excited at 400 nm.



Figure S12. Normalized absorption (dot line) and fluorescence (solid line) spectra of 1d in hexane, toluene, dichloromethane, tetrahydrofuran, acetonitrile and methanol, excited at 400 nm.



Figure S13. Normalized absorption (dot line) and fluorescence (solid line) spectra of 1e in hexane, toluene, dichloromethane, tetrahydrofuran, acetonitrile and methanol, excited at 400 nm.



Figure S14. Normalized absorption (dot line) and fluorescence (solid line) spectra of **1f** in hexane, toluene, dichloromethane, tetrahydrofuran, acetonitrile and methanol, excited at 400 nm.



Figure S15. Normalized absorption (dot line) and fluorescence (solid line) spectra of 1g in hexane, toluene, dichloromethane, tetrahydrofuran, acetonitrile and methanol, excited at 400 nm.



Figure S16. Normalized absorption (dot line) and fluorescence (solid line) spectra of 1h in hexane, toluene, dichloromethane, tetrahydrofuran, acetonitrile and methanol, excited at 420 nm.



Figure S17. Normalized absorption (dot line) and fluorescence (solid line) spectra of **1i** in hexane, toluene, dichloromethane, tetrahydrofuran, acetonitrile and methanol, excited at 430 nm.



Figure S18. Normalized absorption (dot line) and fluorescence (solid line) spectra of **1j** in hexane, toluene, dichloromethane, tetrahydrofuran, acetonitrile and methanol, excited at 480 nm.



Figure S19. Normalized absorption (dot line) and fluorescence (solid line) spectra of 1k in hexane, toluene, dichloromethane, tetrahydrofuran, acetonitrile and methanol, excited at 410 nm.



Figure S20. Normalized absorption (dot line) and fluorescence (solid line) spectra of 2a in hexane, toluene, dichloromethane, tetrahydrofuran, acetonitrile and methanol, excited at 400 nm.



Figure S21. Normalized absorption (dot line) and fluorescence (solid line) spectra of 2b in hexane, toluene, dichloromethane, tetrahydrofuran, acetonitrile and methanol, excited at 400 nm.



Figure S22. Normalized absorption (dot line) and fluorescence (solid line) spectra of BOPSH 2c in hexane, toluene, dichloromethane, tetrahydrofuran, acetonitrile and methanol, excited at 400 nm.



Figure S23. Normalized absorption (dot line) and fluorescence (solid line) spectra of BOPSH 2d in hexane, toluene, dichloromethane, tetrahydrofuran, acetonitrile and methanol, excited at 420 nm.



Figure S24. Normalized absorption (dot line) and fluorescence (solid line) spectra of BOPSH **2e** in hexane, toluene, dichloromethane, tetrahydrofuran, acetonitrile and methanol, excited at 400 nm.

4.2 Absorbance variation in different concentrations



Figure S25. (a) Absorbance of **1a** in toluene in different concentrations. (b) The linear relationship of the absorbance of **1a** in toluene with the concentration variation from 2 μ M to 40 μ M.



4.3 Photostability and pH stability

Figure S26. (a) Absorbance changes of **1a** and fluorescein under continuous irradiation with a 50 W LED lamp with a light dose of 84 J/cm². Change of absorption of **1a** (b) in toluene and fluorescein (c) in 0.1 mol/L sodium hydroxide aqueous solution, respectively, with the irradiation at 50 W LED lamp; 35 mW cm⁻²; 25 °C. (d) Absorbance changes of **1a** versus different pH values in PBS containing 1% acetonitrile as cosolvent. Inserted plot is the relative absorption changes of **1a** in different pH values.

4.4 Thermos gravimetric analysis



Figure S27. Thermos gravimetric analysis (TGA) curves of BOPSHs 1a and 1d.

4.5 Normalized absorption and emission in dichloromethane and solid states



Figure S28. Normalized absorption (blue line) and fluorescence emission (green line) spectra of BOPSH **1a** in dichloromethane excited at 410 nm, fluorescence spectra of BOPSH **1a** in the pristine powder solid state (red line) excited at 420 nm, and its solid-state fluorescence photos under a daylight and 365 nm lamp, respectively.



Figure S29. Normalized absorption (blue line) and fluorescence emission (green line) spectra of BOPSH **1b** in dichloromethane excited at 410 nm, fluorescence spectra of BOPSH **1b** in the pristine powder solid state (red line) excited at 440 nm, and its solid-state fluorescence photos under a daylight and 365 nm lamp, respectively.



Figure S30. Normalized absorption (blue line) and fluorescence emission (green line) spectra of BOPSH **1d** in dichloromethane excited at 410 nm, fluorescence spectra of BOPSH **1d** in the pristine powder solid state (red line) excited at 420 nm, and its solid-state fluorescence photos under a daylight and 365 nm lamp, respectively.


Figure S31. Normalized emission spectrum of BOPSH 1e in the pristine powder solid state, excited at 410 nm, and its solid-state fluorescence photos under the 365 nm lamp.



Figure S32. Normalized absorption (blue line) and fluorescence emission (green line) spectra of BOPSH **1f** in dichloromethane excited at 410 nm, fluorescence spectra of BOPSH **1f** in the pristine powder solid state (red line) excited at 420 nm, and its solid-state fluorescence photos under a daylight and 365 nm lamp, respectively.



Figure S33. Normalized fluorescence emissionspectra of BOPSH 1g in the pristine powder solid state, excited at 420 nm, and its solid-state fluorescence photos under the 365 nm lamp.



Figure S34. Normalized absorption (blue line) and fluorescence emission (green line) spectra of BOPSH **1h** in dichloromethane excited at 420 nm, fluorescence spectra of BOPSH **1h** in the pristine powder solid state (red line) excited at 440 nm, and its solid-state fluorescence photos under a daylight and 365 nm lamp, respectively.



Figure S35. Normalized absorption (blue line) and fluorescence emission (green line) spectra of BOPSH **1i** in dichloromethane excited at 430 nm, fluorescence spectra of BOPSH **1i** in the pristine powder solid state (red line) excited at 460 nm, and its solid-state fluorescence photos under a daylight and 365 nm lamp, respectively.



Figure S36. Normalized emission spectrum of 1j in the pristine powder solid state, excited at 510 nm, and its solid-state fluorescence photos under the 365 nm lamp.



Figure S37. Normalized emission spectrum of 2a in the pristine powder solid state, excited at 410 nm.



Figure S38. Normalized emission spectrum of 2b in the pristine powder solid state, excited at 410 nm.



Figure S39. Normalized fluorescence spectra of BOPSH dyes **1a** (a) and **1i** (b) in the solid state of pristine powder, crystal, grind and heat, excited at 420 nm and 510 nm, respectively; XRD patterns of **1a** (c) and **1i** (d) in crystal and powder states. Prepare powder by grinding the corresponding crystals for 1 minute.

5. Electrochemical properties

E _{1/2} = -2.08 V	1a	E _{pa} = 1.26 V
E _{1/2} = -2.19 V	1h	E _{1/2} = 0.91 V
$E_{1/2} = -2.22 V$	1i	E _{1/2} = 0.81 V
E _{1/2} = -1.96 V	1j	E _{1/2} = 0.58 V
E _{pc} = -2.62, -2.04	V	E _{pc} = 0.49 V
-2.5 -2.0 -1.5 -1 Potentia	I.0 -0. I (V)	5 0.0 0.5 1.0 VS Fc/Fc ⁺

Figure S40. Electrochemical data of BOPSHs 1a and 1h-j (1 mM).

Table S8. Electrochemica	l data and HOMO-LUMO e	energy levels of BOPSHs 1a and 1h-j
--------------------------	------------------------	-------------------------------------

dvo	E_{pa}^{1}	E_{pc}^{1}	Eox	Ered ^{onset}	HOMO	LUMO	E_{g}	
uye	(V)	(V)	(V)	(V)	(eV)	(eV)	(eV)	
1 a	1.26	-2.18	1.03	-1.94	-5.43	-2.46	2.97	
1h	1.01	-2.28	0.83	-2.11	-5.23	-2.29	2.94	
1i	0.88	-2.30	0.75	-2.13	-5.15	-2.27	2.88	
1j	0.66	-2.03, -2.61	0.51	-1.89	-4.91	-2.51	2.40	
r onset	the final	t avidation moals	motortial. E	onset _ the m	advation moal	motortial. E	onset	~

 E_{pa}^{onset} = the first oxidation peak potential; E_{pc}^{onset} = the reduction peak potential; E_{red}^{onset} = the onset reduction potential; E_{ox}^{onset} = the onset oxidation potential; Ferrocene in dichloromethane was used as the external reference with a half wave potential of 0.43 V. E_{LUMO} = -e(E_{red}^{onset} + 4.4); E_{HOMO} = -e(E_{on}^{onset} + 4.4).

 $\text{H-1} \rightarrow \text{L} \ 40.5\%$

 $H \rightarrow L+1 39.8\%$ $\text{H-1} \rightarrow \text{L+1 11.8\%}$



6. Density functional theory calculations

1j

 S_2

357

Figure S41. Isosurfaces of frontier molecular orbitals of BOPSHs 1a, 1i, and ij. Isovalue = 0.03.

Table 59.	Molecular	orbital amplitude	pious of homo and L	LOMO energy is	evels of DOPSHS Ia, II, allu
1j in DCM	I at the CA	M-B3LYP/6-311	+G(d,p) level.		
	state	$\lambda_{max, DCM} (nm)$	$\lambda_{max, calculated} (nm)$	f	MO transition
	S_1	412	363	0.328	$H \rightarrow L 91.0\%$
1a	1a S ₂	349	302	0.355	$\begin{array}{c} \text{H-1} \rightarrow \text{L 65.4\%} \\ \text{H} \rightarrow \text{L+1 9.8\%} \end{array}$
	\mathbf{S}_1	433	378	0.424	$H \rightarrow L 91.6\%$
1i	S_2	332	302	0.328	$H-2 \rightarrow L \ 69.4\%$ $H \rightarrow L+1 \ 11.6\%$ $H-2 \rightarrow L+1 \ 9.7\%$
	S ₁	494	439	0.577	$H \rightarrow L 94.5\%$

Table S9 Molecular orbital amplitude plots of HOMO and LUMO energy levels of BOPSHs 13, 11, and

316

0.335

7. Chiral HPLC separation

CHIRAL HPLC REPORT

Compound ID	: 1A
Sample ID	: NTX00004-AHNU-20220627-2_B6
Instrument	: CAS-NT-ANA-HPLC-ST (Shimadzu LC-20AB with PDA detector)
Injection Vol	: 3ul
Location	: tray1 vial6
Acq Method	: C:\1\METHODS\INC_2_0.5_IPA_HEX_10MIN.lcm
Org DataFile	: D:\DATA\data_2022\data_202207\0728\NTX00004-AHNU-20220627-2_B6.lcd
Injection Date	: 7/28/2022 1:02:08 PM
Method	
	Column: Chiral INC-3 100*4.6mm I.D., 3um
	Mobile phase: Phase A for HEX, and Phase B for IPA;
	Gradient elution: 0.5% IPA in HEX
	Flow rate: 0.8mL/min; Detector: PDA
	Column Temp: 40C;





CHIRAL HPLC REPORT

Compound ID	: AHNU-20220627
Sample ID	: NTX00004-AHNU-20220627-P1_B6
Instrument	: CAS-NT-ANA-HPLC-ST (Shimadzu LC-20AB with PDA detector)
Injection Vol	: 0.8ul
Location	: tray1 vial66
Acq Method	: C:\1\METHODS\INC_2_0.5_IPA_HEX_10MIN.lcm
Org DataFile	: D:\DATA\data_2022\data_202208\0819\NTX00004-AHNU-20220627-P1_B06.lcd
Injection Date	: 8/19/2022 2:20:55 PM
Method	•
	Column: Chiral INC-3 100*4.6mm I.D., 3um
	Mobile phase: Phase A for HEX, and Phase B for IPA;
	Gradient elution: 0.5% IPA in HEX
	Flow rate: 0.8mL/min; Detector: PDA
	Column Temp: 40C;



Figure S43. The HPLC analysis report of (*R*)-1a using Ig chiral column.

CHIRAL HPLC REPORT

Compound ID	: AHNU-20220627
Sample ID	: NTX00004-AHNU-20220627-P2_B6
Instrument	: CAS-NT-ANA-HPLC-ST (Shimadzu LC-20AB with PDA detector)
Injection Vol	: 0.1ul
Location	: tray1 vial67
Acq Method	: C:\1\METHODS\INC_2_0.5_IPA_HEX_10MIN.lcm
Org DataFile	: D:\DATA\data_2022\data_202208\0819\NTX00004-AHNU-20220627-P2_B06.lcd
Injection Date	: 8/19/2022 2:31:33 PM
Method	·
	Column: Chiral INC-3 100*4.6mm I.D., 3um
	Mobile phase: Phase A for HEX, and Phase B for IPA;
	Gradient elution: 0.5% IPA in HEX
	Flow rate: 0.8mL/min; Detector: PDA
	Column Temp: 40C



Figure S44. The HPLC analysis report of (*S*)-**1a** using Ig chiral column.



General Information

Log Author	Log Date	Report By	Report Date	Notes
Administrator	10/23/2024 12:07:43 PM	Administrator	10/24/2024	

Run Information

Instrument Method	Inj. Vol.	Solvent	Column	Sample	Well Location	Temp. (C)	Flow (g/min)	% Modifier	Pressure (Bar)
70-30-CO2-SOLVENT	20 uL	ETOH +0.2%DEA	IB	AHSF-01- YELLOW	15B	35	3	30	100

Peak Information

Peak No	% Area	Area	Ret. Time	Height	Cap. Factor
1	49.7581	684.7216	4.27 min	72.9356	4265.6667
2	50.2419	691.3779	5.13 min	60.3005	5132.3333

Figure S45. The HPLC analysis report of 1i using Ib chiral column.



General Information

Log Author	Log Date	Report By	Report Date	Notes
Administrator	10/24/2024	Administrator	10/25/2024	
	2:19:48 PM			

Run Information

Instrument Method	Inj. Vol.	Solvent	Column	Sample	Well Location	Temp. (C)	Flow (g/min)	% Modifier	Pressure (Bar)
70-30-CO2-SOLVENT	20 uL	90%HEX IN ETOH +0.2%DEA	IB	AFSF-01- YELLOW- P1	14C	35	3	30	100

Peak Information

Peak No	% Area	Area	Ret. Time	Height	Cap. Factor
1	99.4533	1083.0748	4.55 min	106.5877	0
2	0.5467	5.9536	5.53 min	0.4881	0

Figure S46. The HPLC analysis report of (*R*)-1i using Ib chiral column.



General Information

Log Author	Log Date	Report By	Report Date	Notes
Administrator	10/24/2024	Administrator	10/25/2024	
	2:08:42 PM			

Run Information

Instrument Method	Inj. Vol.	Solvent	Column	Sample	Well Location	Temp. (C)	Flow (g/min)	% Modifier	Pressure (Bar)
70-30-CO2-SOLVENT	20 uL	90%HEX IN ETOH +0.2%DEA	IB	AFSF-01- YELLOW- P2	15C	35	3	30	100

Peak Information

Peak No	% Area	Area	Ret. Time	Height	Cap. Factor
1	0.4439	4.5276	4.58 min	0.4309	4582.3333
2	99.5561	1015.5235	5.57 min	81.9208	5565.6667

Figure S47. The HPLC analysis report of (*S*)-1i using Ib chiral column.



General Information

Log Author	Log Date	Report By	Report Date	Notes
Administrator	10/23/2024 1:36:45 PM	Administrator	10/27/2024	

Run Information

Instrument Method	Inj. Vol.	Solvent	Column	Sample	Well Location	Temp. (C)	Flow (g/min)	% Modifier	Pressure (Bar)
70-30-CO2-SOLVENT	20 uL	ETOH +0.2%DEA	IC	AHSF-02- RED	16B	35	3	30	100

Peak Information

Peak No	% Area	Area	Ret. Time	Height	Cap. Factor
1	49.8572	639.4755	5.74 min	43.2109	5740.6667
2	50.1428	643.139	7.12 min	34.5466	7115.6667

Figure S48. The HPLC analysis report of 1j using Ic chiral column.



General Information

Log Author	Log Date	Report By	Report Date	Notes
Administrator	10/28/2024 9:56:06 AM	Administrator	10/28/2024	

Run Information

Instrument Method	Inj. Vol.	Solvent	Column	Sample	Well Location	Temp. (C)	Flow (g/min)	% Modifier	Pressure (Bar)
70-30-CO2-SOLVENT	20 uL	80%HEX IN ETOH	IC	AHSF-02- RED-P1	17E	35	3	30	100
		+0.2%DEA							

Peak Information

Peak No	% Area	Area	Ret. Time	Height	Cap. Factor
1	96.0176	324.3683	6.18 min	20.6392	6174
2	3.9824	13.4535	7.6 min	0.7373	7599

Figure S49. The HPLC analysis report of (*R*)-1j using Ic chiral column.



General Information

Log Author	Log Date	Report By	Report Date	Notes
Administrator	10/28/2024 10:17:10 AM	Administrator	10/28/2024	

Run Information

Instrument Method	Inj. Vol.	Solvent	Column	Sample	Well Location	Temp. (C)	Flow (g/min)	% Modifier	Pressure (Bar)
70-30-CO2-SOLVENT	20 uL	80%HEX IN ETOH +0.2%DEA	IC	AHSF-02- RED-P2	18E	35	3	30	100

Peak Information

Peak No	% Area	Area	Ret. Time	Height	Cap. Factor
1	6.449	44.5188	5.84 min	3.0156	5840.6667
2	93.551	645.7971	7.37 min	30.1765	7365.6667

Figure S50. The HPLC analysis report of (*S*)-1j using Ic chiral column.

8. Chiroptical properties

Table S10. The g_{abs} of chiral (*R*)-1a and (*S*)-1a in different solutions such as toluene, dichloromethane and acetonitrile.



dyes	solution	$\lambda_{\max}/nm (g_{abs})$ of (<i>R</i>)-conformation	$\lambda_{max}/nm (g_{abs})$ of (S)-conformation
1a	toluene	415 (1.51×10 ⁻³)	415 (-1.26×10 ⁻³)
	dichloromethane	411 (1.62×10 ⁻³)	411 (-1.59×10 ⁻³)
	acetonitrile	410 (1.27×10 ⁻³)	410 (-1.34×10 ⁻³)

Table S11. The g_{lum} of chiral (*R*)-1a and (*S*)-1a in different solutions such as toluene, dichloromethane, and acetonitrile.

dyes	solution	$\lambda_{\max}/nm (g_{lum})$ of	λ_{\max}/nm (<i>g</i> _{<i>lum</i>}) of	
		(<i>R</i>)-conformation	(S)-conformation	
	hexane	453 (1.01×10 ⁻³)	454 (-1.28×10 ⁻³)	
	toluene	454 (1.06×10 ⁻³)	454 (-1.22×10 ⁻³)	
	dichloromethane	462 (0.82×10 ⁻³)	459 (-1.39×10 ⁻³)	
10	tetrahydrofuran	459 (1.01×10 ⁻³)	461 (-1.15×10 ⁻³)	
18	acetonitrile	466 (1.02×10 ⁻³)	465 (-1.28×10 ⁻³)	
	methanol	466 (1.41×10 ⁻³)	467 (-1.40×10 ⁻³)	
	di watan	481 (9.67×10 ⁻⁴)	479 (-1.09×10 ⁻³)	
	di-water	508 (7.50×10 ⁻⁴)	510 (-1.14×10 ⁻³)	



Figure S51. The CD (a) and g_{abs} (b) spectra of (*S/R*)-1a in toluene.



Figure S52. The CD (a) and g_{abs} (b) spectra of (*S/R*)-1a in dichloromethane.



Figure S53. The CD (a) and g_{abs} (b) spectra of (*S*/*R*)-1a in acetonitrile.



Figure S54. Calculated CD spectrum of (*R*)-1a at the CAM-B3LYP/6-311+G(d,p)/(IEFPCM, CH₂Cl₂) level.



Figure S55. The CD and g_{abs} spectra of (S/R)-1i (a, b) and (S/R)-1j (c, d) in dichloromethane.



Figure S56. The CPL spectra of (*S/R*)-1a in hexane (a), toluene (b), tetrahydrofuran (c), acetonitrile (d) and methanol (e).

9. Electroluminescence performance

Ta	Table S12. The EL performance of OLEDs. ^a								
Device	λ _{EL} (nm)	V (V)	I (cd m ⁻²)	$\eta_{\rm C} ({\rm cd} {\rm A}^{-1})$	$\eta_{ m P} ({ m lm}{ m W}^{-1})$	η_{ext} (%)			
_	Device	$\chi_{\rm EL}$ (IIIII)	• on (•)		ma	naximum value/at 1000 cd m ⁻²	1000 cd m^{-2}		
	A1	492	3.1	9559	10.8/7.5	9.9/4.9	5.0/3.5		
	A2	492	3.0	9493	11.2/7.7	11.0/5.0	5.0/3.5		

^aAbbreviations: V_{on} = turn-on voltage at 1 cd m⁻²; L_{max} = maximum luminance; $\eta_C/\eta_P/\eta_{ext}$ = current efficiency/power efficiency/external quantum efficiency at maximum value and 1000 cd m⁻²



Figure S56. (a) Molecule structures of functional layer and photographs of the fabricated devices mentioned in Figure 5a, corresponding to (R)-1a (b) and (S)-1a (c), respectively.

Table S13. EL performance of the configuration of "ITO/MoO₃ (5 nm)/*m*CBP (25 nm)/EML (20 nm)/PO-T2T (5 nm)/TmPyPB (25 nm)/LiF (1 nm)/Al" (EML: 3%(*R*)-1a: *m*CBP: PO-T2T (3: 48.5: 48.5))

Repetition	$\lambda_{EL}(nm)$	$V(\mathbf{V})^b$	L	$\eta_{\rm C} ({\rm cd} {\rm A}^{-1})^a$	$\eta_{ m P} ({ m lm}~{ m W}^{-1})^a$	$\eta_{ m ext}(\%)^a$
			$(cd m^{-2})^a$	maximum value / at 1000 cd m^{-2}		
1	492	3.1	9006	10.4/7.6	9.3/5.0	4.8/3.6
2	492	3.1	9080	10.6/7.7	9.6/5.0	4.9/3.6
3	492	3.1	9633	10.6/7.6	9.6/4.6	4.9/3.5
4	492	3.1	9534	10.5/7.5	9.7/4.5	4.8/3.5

Table S14. EL performance of the configuration of "ITO/MoO₃ (5 nm)/*m*CBP (25 nm)/EML (20 nm)/PO-T2T (5 nm)/TmPyPB (25 nm)/LiF (1 nm)/Al" (EML: 3%(*S*)-**1a**: *m*CBP: PO-T2T (3: 48.5: 48.5))

Repetition	$\lambda_{EL}(nm)$	$\sim V$	L	$\eta_{\rm C} ({\rm cd} \; {\rm A}^{-1})^a$	$\eta_{ m P} ({ m lm}~{ m W}^{-1})^a$	$\eta_{\rm ext} (\%)^a$
		$(\mathbf{V})^b$	$(cd m^{-2})^a$	cd m ⁻²		
1	492	3.1	10150	10.7/7.4	10.5/4.4	4.8/3.4
2	492	3.1	9785	10.9/7.4	9.7/4.5	4.9/3.4
3	492	3.1	10160	10.9/7.8	10.4/4.7	4.9/3.6
4	492	3.1	10190	10.9/7.9	10.3/4.8	4.9/3.6

construction strategy	Chiral materials	Emitters	g_{PL}	$g_{\scriptscriptstyle EL}$	Ref.
chiral small	<i>R/S</i> -BOPSH 1a	3 wt% <i>R</i> -1a 48.5 wt% PO- T2T: 48.5 wt% mCBP	0.91×10 ⁻³	1.86×10^{-3} -3.07 × 10 ⁻³	This work
	<i>R/S</i> -BNPCN- <i>p</i> -CP	Ir(tptpy) ₂ acac 4CzTPNBu BN3	-18.10/17.50 × 10 ⁻⁴ (neat film)	$\begin{array}{c} -2.32 \times 10^{-3} \\ -2.87 \times 10^{-3} \\ -2.70 \times 10^{-3} \end{array}$	10
molecules host	<i>R/S-</i> BN- <i>m</i> CP <i>R/S-</i> BN-2 <i>m</i> CP	Ir(mppy) ₃	-	$\begin{array}{c} 1.3 \times 10^{-3} / \\ -1.7 \times 10^{-3} \\ 2.1 \times 10^{-3} / \\ -1.3 \times 10^{-3} \end{array}$	11
	<i>R/S-</i> L-2 <i>m</i> CPCN	Ir(mppy) ₃ BN5	-1.4 × 10 ⁻³ /1.3 × 10 ⁻³ 4.3 × 10 ⁻³	$\begin{array}{c} -1.4 \times 10^{-3} / \\ 1.5 \times 10^{-3} \\ -5.0 \times 10^{-3} / \\ 5.0 \times 10^{-3} \end{array}$	12
chiral host superamolecular assembly system	<i>R/S</i> -P1 <i>R/S</i> -P2 <i>R/S</i> -P3	ВРу	0.0096 0.042 0.031	-0.021±0.001 <i>R</i> -P2-BPy +0.020±0.002 <i>S</i> -P2-BPy	13
	<i>R/S</i> -CzOBN (donor)\POT2T (acceptor)	BN1	±2.4 × 10 ⁻³ (<i>R/S</i> -CzOBN : POT2T-BN1 film)	$\pm 2.8 \times 10^{-3}$	14
chiral exciplex as host materials	TAPC (donor)	<i>R/S</i> -TRZ (acceptor)	2.73 × 10 ⁻³ -3.39× 10 ⁻³	7.25×10^{-3} -9.89 × 10 ⁻³	15
	TCTA (donor) R/S- TRZOBN (acceptor)		1.4 × 10 ^{-3/} -1.1 × 10 ⁻³ (TCTA : <i>R/S</i> -TRZOBN film)	3.2 × 10 ⁻³ -3.1 × 10 ⁻³	16
chiral polymer host	JY ₀ / JY ₁₀₀ chiral helical polymer host	<i>R/S</i> -Pt(II)	$\begin{array}{c} 0.65 \times 10^{-3/} \\ -0.73 \times 10^{-3} \\ (R/S\text{-Pt:}\mathbf{JY_0} \text{ film}) \\ 1.0 \times 10^{-3/}\text{-}0.94 \times 10^{-3} \\ (R/S\text{-Pt:}\mathbf{JY_{100}} \text{ film}) \end{array}$	1.09 × 10 ⁻⁴ (<i>R/S</i> -Pt(II):JY ₁₀₀)	17
	cPF8PhO8 chiral polyfluorene host	<i>R/S</i> -BN- MDPA	9.0 × 10 ⁻² (<i>R</i>-BN-MDPA film) 1.4 × 10 ⁻² (<i>R</i>-BN-MDPA : cPF8PhO8 film)	0.091	18

Table S15. Comparison of electroluminescence features for the CP-OLED emitting layer materials



¹³C NMR (126 MHz) of BOPSH 1a in CDCl₃



¹³C NMR (126 MHz) of BOPSH 1b in CDCl₃





¹³C NMR (126 MHz) of BOPSH 1d in CDCl₃

-0.000



¹H NMR (500 MHz) of BOPSH 1e in CDCl₃









¹³C NMR (126 MHz) of BOPSH 1g in CDCl₃









S68









¹³C NMR (126 MHz) of BOPSH 2a in CDCl₃


¹³C NMR (126 MHz) of BOPSH **2b** in CDCl₃





 ^{13}C NMR (101 MHz) of BOPSH 2c in CDCl_3



 $^{19}\mathrm{F}$ NMR (377 MHz) of BOPSH 2c in CDCl_3

Electronic Supporting Information





¹³C NMR (126 MHz) of BOPSH 2d in CDCl₃



¹⁹F NMR (471 MHz) of BOPSH 2d in CDCl₃

Electronic Supporting Information





11. HRMS for the new BOPSHs



HRMS for BOPSH 1a

HRMS for BOPSH 1b



HRMS for BOPSH 1c



HRMS for BOPSH 1d



HRMS for BOPSH 1e



HRMS for BOPSH 1f



627.0 627.4 627.8 628.2 628.6 629.0 629.4 629.8 630.2 630.6 631.0 631.4 631.8 632.2 632.6 633.0 m/z (Da)

Electronic Supporting Information



HRMS for BOPSH 1h



505. 8 506. 0 506. 2 506. 4 506. 6 506. 8 507. 0 507. 2 507. 4 507. 6 507. 8 508. 0 508. 2 508. 4 508. 6 508. 8 509. 0 509. 2 509. 4 509. 6 509. 8 510. 0 510. 2 510. 4 510. 6 510. 8 m/z (Da)



HRMS for BOPSH 1i







HRMS for BOPSH 1k







HRMS for BOPSH 2b





HRMS for BOPSH 2c

HRMS for BOPSH 2d



HRMS for BOPSH 2e



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