### Supporting Information

# Efficient narrowband bluish-green emitters derived from double-carbazole-fused organoboron multiple resonance skeleton with internal-structure modification

Tong-Yuan Zhang,<sup>a†</sup> Ying-Chun Cheng,<sup>a†</sup> Hui Wang,<sup>a</sup> Feng Huang,<sup>a</sup> Xin Xiong,<sup>a</sup> Xiao-Chun Fan,\*<sup>a</sup> Jia Yu, <sup>ab</sup> Kai Wang<sup>\*ac</sup> and Xiao-Hong Zhang<sup>\*ab</sup>

<sup>a</sup> Institute of Functional Nano & Soft Materials (FUNSOM), Soochow University, Suzhou, Jiangsu 215123, P. R. China

<sup>b</sup> Jiangsu Key Laboratory of Advanced Negative Carbon Technologies, Soochow University, Suzhou, 215123, Jiangsu, PR China

<sup>c</sup> Jiangsu Key Laboratory for Carbon-Based Functional Materials & Devices, Soochow University, Suzhou, 215123, Jiangsu, PR China

<sup>†</sup> These authors contributed equally.

### **General information**

**Synthesis**. The chemicals and reagents purchased commercially were used without further purification unless otherwise stated. The main synthesis was performed using standard Schlenk techniques under a nitrogen atmosphere, and the target molecules were further purified by sublimation. <sup>1</sup>H and <sup>13</sup>C NMR spectra were measured on a Bruker 600/400 MHz spectrometer with tetramethylsilane (TMS) as the internal standard. Mass analyses were recorded by an Autoflex MALDI-TOF mass spectrometer.

**Thermal measurement.** Thermogravimetric analysis (TGA) was carried out on a Perkin Elmer thermal analysis system (TA SDT 2960) at a heating rate of 10 °C min<sup>-1</sup> from 30 °C to 800 °C under nitrogen. The temperature of 5% weight loss was defined as the decomposition temperature (T<sub>d</sub>). Differential scanning calorimetry (DSC) curves were obtained on a TA DSC 2010 unit at a heating rate of 10 °C min<sup>-1</sup> from 0 to 350 °C under nitrogen, and no obvious glass transition temperature was observed, suggesting its thermal stability.

**Electrochemical measurement.** Cyclic voltammetry (CV) was carried out on a CHI660E electrochemical analyzer at room temperature. Dry DCM was used as the solvent with tetrabutylammonium hexafluorophosphate (TBAPF<sub>6</sub>) (0.1 M) as the supporting electrolyte. The cyclic voltammograms (CV) were obtained at a scan rate of 0.05 V·S<sup>-1</sup> with platinum electrode as the working/counter electrode and a silver chloride electrode as the reference electrode with standardization against ferrocene/ferrocenium. Cyclic voltammetry (CV) was carried out on a CHI660E electrochemical analyzer using silver chloride electrode and Pt disk as reference electrode and working electrode. In the experiments, 0.1M tetrabutylammonium perchlorate in  $10^{-3}$  M dichloromethane solution was used as the supporting electrolyte

V/s under nitrogen atmosphere. The ionization potential  $(E_{HOMO})$  of the compounds were determined from the onset positions relative to the half-wave potential of Fc<sup>+</sup>/Fc by using the equation  $E_{HOMO}$  [eV] = -( $E_{ox}$ -  $E_{1/2,Fc}$  + 5.1) eV. Likewise, the energy levels of LUMO ( $E_{LUMO}$ ) were calculated with the equation  $E_{HOMO}$  [eV] = -( $E_{re}$ -  $E_{1/2}$ ,  $_{\rm Fc}$  + 5.1) eV.

Photophysical measurements. UV–Vis absorption and photoluminescence (PL) spectra were recorded by using a Hitachi ultraviolet-visible (UV-Vis) spectrophotometer U-3010 and a Hitachi fluorescence spectrometer F-4600, respectively. The PL quantum efficiency (PLQY) was measured via an absolute PL quantum yield measurement system (C9920-02, Hamamatsu Photonics) in glovebox with an excitation wavelength of 300 nm. Transient decay measurements were carried out with an Edinburgh fluorescence spectrometer (FLS920).

Analysis of rate constants. The calculations for the key rate constants of its kinetic process are expressed as follows:<sup>1, 2</sup>

$$\varphi_{total} = \varphi_p + \varphi_d \varphi_T = 1 - \varphi_p$$

$$k_p = \frac{1}{\tau_p} k_d = \frac{1}{\tau_d}$$

$$k_r^S = k_p \varphi_p k_{ISC} = k_p (1 - \varphi_p)$$

$$k_{RISC} = \frac{k_p k_d \varphi_d}{k_{ISC} \varphi_p} k_{nr}^T = k_d - \left(1 - \frac{k_{ISC}}{k_p}\right) k_{RISC}$$

'n

where  $\varphi_p$  and  $\varphi_d$  are the prompt and delayed fluorescence quantum efficiencies, respectively;  $\varphi_T$  is the ISC efficiency; and  $k_p$ ,  $k_{RISC}$ , and  $k_d$  are the rate constants of prompt fluorescence, RISC, and delayed fluorescence decay, respectively.  $k_r^S$  and  $k_{nr}^T$ are the rate constants of the singlet radiative transition and triplet nonradiative transition, respectively.

Theoretical calculation. The front molecular orbitals (FMOs) of the optimized

ground state and excited state were calculated with time-dependent density function theory (TD-DFT) employing the PEB0/6-31g(d,p) basis set in the Gaussian 16 program package. All these quantum-chemistry calculations were performed by the Gaussian 16 software package<sup>3</sup> and based on the optimized ground-state geometries. Device fabrication and measurement of EL characteristics. OLEDs were fabricated on indium tin oxide (ITO)-coated transparent glass substrates with multiple layers. The ITO glass substrates have a thickness of ca. 100 nm and a sheet resistance of ca. 30  $\Omega$  per square and were cleaned with optical detergent, deionized water, acetone, and isopropanol successively and then dried in an oven. Before device fabrication, the substrates were cleaned with ethanol, isopropanol, and deionized water, dried in an oven, and finally exposed to UV ozone for 15 min. All the organic materials and metal layers were thermally evaporated under a vacuum of ca. 10<sup>-5</sup> Torr. Four identical OLED devices were formed on each of the substrates, and the emission area was 0.1 cm<sup>2</sup> for each device. The EL performances of all devices were measured with a KEITHLEY 2400 Source Meter constant current source, and the external quantum efficiency of the devices was obtained by measuring the light intensity in the forward direction by using an integrating sphere (Hamamatsu C9910-11&12).

### **Experimental**

Synthesis



Scheme S1 Synthesis route of BTPCzBN and BTPBN. Reaction conditions: (i)  $Cs_2CO_3$ , DMF; (ii) (1)n-BuLi, Mesitylene, (2)BBr<sub>3</sub>, (3)DIEA. The compound tBuInPz was synthesized and obtained with reference to the literature.

### Synthesis of 2a 10-(2-bromo-3-(3,6-di-tert-butyl-9H-carbazol-9-yl)phenyl)-10Hbenzo[4,5]thieno[3,2-b]indole :

Under a nitrogen atmosphere, a mixture of 10H-benzo[4,5]thieno[3,2-b]indole (BTI) (1.02 g, 4.57 mmol), 9-(2-bromo-3-fluorophenyl)-3,6-di-tert-butyl-9H-carbazole 1a (2.06 g, 4.57 mmol), cesium carbonate (3 g, 9.23 mmol) and N,N-dimethylformamide (40 mL) were added into a 250 mL two-necked reaction flask. The mixture was heated to 160 °C and stirred for 12 h. After cooling to room temperature, the reaction mixture was poured into 200 mL water and filtered to obtain grey solid. The crude product was further purified by column chromatography (PE: DCM = 8:1) to obtain white solid **2a** (2.13 g, 71%). <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)  $\delta$  8.16 (t, J = 1.5 Hz, 2H), 7.93 – 7.87 (m, 1H), 7.83 (d, J = 7.7 Hz, 1H), 7.70 (d, J = 1.8 Hz, 3H), 7.48 (ddd, J = 13.0, 8.6, 1.9 Hz, 2H), 7.40 – 7.25 (m, 5H), 7.20 – 7.09 (m, 3H), 1.46 (d, J = 4.5 Hz, 18H).<sup>13</sup>C NMR (101 MHz, CDCl<sub>3</sub>)  $\delta$  143.33, 143.28, 143.24, 142.11, 139.77, 139.65, 139.30, 139.10, 137.48, 131.75, 130.78, 129.34, 126.89, 126.17, 124.58, 124.43, 124.35, 123.92, 123.84, 123.55, 122.35, 120.92, 119.63, 119.57, 117.09, 116.60, 116.56, 111.12, 109.53, 109.42, 34.86, 32.11. Chemical Formula: C<sub>40</sub>H<sub>35</sub>BrN<sub>2</sub>S.

MALDI-TOF: calculated: 655.70, found: 655.66. Anal. Calcd (%) for C, 73.27; H, 5.38; Br, 12.19; N, 4.27; S, 4.89; Found: C, 73.31; H, 5.36; N, 12.92.

## Synthesis of 2b (10,10'-(2-bromo-1,3-phenylene)bis(10H-benzo[4,5]thieno[3,2b]indole)):

Under a nitrogen atmosphere, a mixture of 2-bromo-1,3-difluorobenzene 1b (0.882 g, 4.57 mmol), 10H-benzo[4,5]thieno[3,2-b]indole (BTI) (0.51 g, 2.28 mmol), and cesium carbonate (3 g, 9.23 mmol), and N,N-dimethylformamide (40 mL) were added into a 250 mL two-necked reaction flask. After cooling to room temperature, the reaction mixture was poured into 200 mL water and filtered to obtain gray solid. The crude product was further purified by column chromatography (PE: DCM = 10:1) to obtain white solid **2b** (1.1 g, 80%). <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) 1H NMR (400 MHz, Chloroform-d)  $\delta$  7.98 – 7.86 (m, 2H), 7.55 (d, J = 8.7 Hz, 1H), 7.41 – 7.27 (m, 14H), 7.13 (ddd, J = 18.4, 8.5, 2.6 Hz, 2H).<sup>13</sup>C NMR data could not be obtained due to poor solubility. Chemical Formula: C<sub>34</sub>H<sub>19</sub>BrN<sub>2</sub>S<sub>2</sub>. MALDI-TOF: calculated: 599.56, found: 599.60. Anal. Calcd (%) for C, 68.11; H, 3.19; Br, 13.33; N, 4.67; S, 10.69; Found: C, 68.08; H, 3.16; N, 4.71.

#### Synthesis of BTPCzBN:

Under a nitrogen atmosphere, a solution of butyllithium in pentane (5 mL, 2.50 M, 13 mmol) was slowly added to a solution of 2a (3 g, 5 mmol) in mesitylene (100 mL) at - 78 °C. After stirring for 2 h at 60 °C, the mixture was slowly cooled to room temperature and stirred for an additional 0.5 h. BBr<sub>3</sub> (0.8 mL, 9.0 mmol) was added dropwise at -40 °C. The mixture was slowly warmed to room temperature and stirred for an additional 1 h. Then, N,N-diisopropylethylamine (1.6 mL, 9.0 mmol) was added at 0 °C. In the end, the mixture was heated to 160 °C for an additional 12 h. After cooling to room temperature, the reaction mixture was carefully quenched by MeOH (20 mL) and water (100 mL), and the pH of the reaction mixture was adjusted

to 7 by phosphate buffer and concentrated in vacuo. The crude product was purified by column chromatography (PE: DCM = 40:1) to obtain orange yellow powder (1.5 g, 51%). 1H NMR (400 MHz, Chloroform-d)  $\delta$  8.93 (s, 1H), 8.72 (d, J = 7.4 Hz, 1H), 8.47 (s, 2H), 8.33 (d, J = 8.8 Hz, 1H), 8.29 – 8.20 (m, 2H), 8.05 (d, J = 8.1 Hz, 1H), 7.99 – 7.91 (m, 2H), 7.87 (tt, J = 8.3, 1.2 Hz, 1H), 7.66 (dd, J = 8.8, 2.1 Hz, 1H), 7.57 (t, J = 7.5 Hz, 1H), 7.47 (ddd, J = 8.2, 7.1, 1.1 Hz, 1H), 7.39 (td, J = 7.5, 7.1, 1.1 Hz, 1H), 1.69 (s, 9H), 1.58 (s, 9H). Chemical Formula: C<sub>40</sub>H<sub>33</sub>BN<sub>2</sub>S. MALDI-TOF: calculated: 584.59, found: 584.66. Anal. Calcd (%) for C, 82.18; H, 5.69; B, 1.85; N, 4.79; S, 5.48; Found: C, 82.15; H, 5.66; N, 4.82.

### Synthesis of BTPBN:

BTPBN was prepared in accordance with BTPCzBN by using 2b (683 mg, 1.14 mmol). Orange yellow powder (397 mg, 66%). 1H NMR (400 MHz, Methylene Chloride-d2)  $\delta$  8.71 (d, J = 8.9 Hz, 2H), 8.24 (dd, J = 7.7, 1.9 Hz, 2H), 8.14 (s, 2H), 8.11 (d, J = 2.3 Hz, 10H), 8.07 (d, J = 6.9 Hz, 1H). <sup>13</sup>C NMR data could not be obtained due to poor solubility. Chemical Formula: C<sub>34</sub>H<sub>17</sub>BN<sub>2</sub>S<sub>2</sub>. MALDI-TOF: calculated: 528.45, found: 528.38. Anal. Calcd (%) for C, 77.28; H, 3.24; B, 2.05; N, 5.30; S, 12.13; Found: C, 77.26; H, 3.20; N, 5.28.



Figure S1. TGA and DSC curves of (a)/(c) BTPCzBN and (b)/(d) BTPBN.

Compound	HOMO/ eV	LUMO/ eV	Energy gap/ eV
BTPCzBN	-5.14	-1.89	3.25
BTPBN	-5.22	-2.07	3.15
CzBN <sup>4</sup>	-5.25	-1.84	3.41

Table S1. Calucation results of BTPCzBN, BTPBN and CzBN

Table S2. Crystal data and structure refinement for BTPCzBN

CCDC number	2297252
Empirical formula	$C_{40}H_{33}BN_2S$
Formula weight	584.55
Temperature/K	100
Crystal system	monoclinic
Space group	$P2_1/c$
a/Å	15.8894(4)
b/Å	11.3576(3)

c/Å	18.1255(4)
$\alpha/^{\circ}$	90
β/°	114.2210(10)
$\gamma/^{o}$	90
Volume/Å <sup>3</sup>	2983.08(13)
Ζ	4
$\rho_{calc}g/cm^3$	1.302
$\mu/\text{mm}^{-1}$	0.142
F(000)	1232.0
Crystal size/mm <sup>3</sup>	0.15  imes 0.08  imes 0.05
Radiation	MoKa ( $\lambda = 0.71073$ )
$2\Theta$ range for data collection/	° 4.352 to 52.802
Index ranges	$\text{-}18 \leq h \leq 19,  \text{-}14 \leq k \leq 14,  \text{-}22 \leq l \leq 22$
Reflections collected	27353
Independent reflections	$6052 [R_{int} = 0.0686, R_{sigma} = 0.0543]$
Data/restraints/parameters	6052/0/403
Goodness-of-fit on F <sup>2</sup>	1.016
Final R indexes [I>= $2\sigma$ (I)]	$R_1 = 0.0454, wR_2 = 0.1010$
Final R indexes [all data]	$R_1 = 0.0656, wR_2 = 0.1124$
Largest diff. peak/hole/e Å <sup>-3</sup>	0.29/-0.31

 Table S3. Crystal data and structure refinement for BTPBN.

CCDC number	2305070
Empirical formula	$C_{34}H_{17}BN_2S_2$
Formula weight	528.42
Temperature/K	100
Crystal system	monoclinic
Space group	C2
a/Å	41.9104(11)
b/Å	3.82650(10)
c/Å	28.3354(7)
$\alpha/^{\circ}$	90
β/°	94.432(2)
γ/°	90
Volume/Å <sup>3</sup>	4530.6(2)
Z	8
$\rho_{calc}g/cm^3$	1.549

μ/mm <sup>-1</sup>	2.365
F(000)	2176.0
Crystal size/mm <sup>3</sup>	$0.09\times0.08\times0.04$
Radiation	$CuK\alpha$ ( $\lambda = 1.54178$ )
$2\Theta$ range for data collection/	<sup>o</sup> 4.23 to 127.464
Index ranges	$-48 \le h \le 48,  -4 \le k \le 4,  -32 \le l \le 32$
Reflections collected	22973
Independent reflections	7244 [ $R_{int} = 0.0729, R_{sigma} = 0.0650$ ]
Data/restraints/parameters	7244/1/703
Goodness-of-fit on F <sup>2</sup>	1.072
Final R indexes [I>= $2\sigma$ (I)]	$R_1 = 0.0584, wR_2 = 0.1464$
Final R indexes [all data]	$R_1 = 0.0614, wR_2 = 0.1480$
Largest diff. peak/hole/e Å $^{-3}$	0.54/-0.51
Flack parameter	0.116(13)



**Figure S2**. Normalized emission spectra of (a) BTPCzBN and (b) BTPBN in various solvents.

**Table S4.** Summary of data on solvation tests of BTPBN and BTPCzBN.

	B	「PCzBN	BTPBN		
Solvent	$\lambda_{em}$	FWHM	$\lambda_{em}$	FWHM	
	/nm	/ nm (eV)	/nm	/ nm (eV)	
Hex	482	21 (0.09)	488	20 (0.09)	
Tol	498	24 (0.10)	500	25 (0.12)	
DCM	502	24 (0.10)	503	33 (0.13)	

Compound	$\lambda_{abs}^{[a]}$	$\lambda_{em}^{[b]}$	FWHM	$E_{\rm S}^{\rm [c]}$	$E_{\mathrm{T}}^{\mathrm{[d]}}$	$\Delta E_{\rm ST}$
	[nm]	[nm]	[nm/meV]	[eV]	[eV]	[eV]
BTPCzBN	473	498	23/97	2.14	1.89	0.25
BTPBN	481	500	25/101	2.15	1.82	0.33

Table S5. Summary of the photophysical properties of BTPCzBN and BTPBN

[a] Peak for the lowest energy band curve. [b] Measured in toluene  $(1 \times 10^{-5} \text{ M}, 298 \text{ K})$ . [c]Estimated from the onset of the spectra in toluene  $(1 \times 10^{-5} \text{ M}, 298 \text{ K})$ . [d] Estimated from the onset of the spectra in toluene  $(1 \times 10^{-5} \text{ M}, 77 \text{ K})$ .



**Figure S3**. Transient PL curves of the prompt emission at 300 K for (a) BTPCzBN 1 wt% and (b) BTPBN 1 wt% doped in PhCzBCz films. Transient PL curves of the prompt emission at 300 K for (c) BTPCzBN 1 wt% and (d) BTPBN 1 wt% doped in PhCzBCz films.

Table S6	. Summary	of kinetic	constant	data of t	he BTP0	CzBN	1% and	BTPBN	1 v	vt%
doped in ]	PhCzBCz f	ilms.								

Emitter	$arPsi_{ ext{PL}}^{[a]}$	$ au_{p}^{[b]}$	$ au_d^{[c]}$	$arphi_{ m p}$	$arphi_{ m d}$	$k_{\rm ISC}^{\rm [d]}$	$k_{\rm RISC}^{[e]}$	$k_{\rm r}^{\rm [f]}$
	(%)	(ns)	(µs)	(%)	(%)	$(10^8  \text{s}^{-1})$	$(10^2  \text{s}^{-1})$	$(10^8  \text{s}^{-1})$

BTPCzBN	91	4.66	788.72	76	15	0.51	10.03	1.64
BTPBN	80	2.89	871.30	56	24	0.57	11.00	0.74

<sup>[a]</sup> The photoluminescence quantum yields ( $\Phi_{PL}$ ) measured as thin films in host matrices of PhCzBCz at 300 K under a N<sub>2</sub> atmosphere. <sup>[b]</sup> Emission lifetimes for prompt fluorescence ( $\tau_p$ ). <sup>[c]</sup> Emission lifetimes for delayed fluorescence ( $\tau_d$ ). [d] Rate constants of intersystem crossing (ISC) (S<sub>1</sub> $\rightarrow$ T<sub>1</sub>) ( $k_{ISC}$ ). <sup>[e]</sup> The rate constants of reverse intersystem crossing (RISC) (T<sub>1</sub> $\rightarrow$ S<sub>1</sub>) ( $k_{RISC}$ ). <sup>[f]</sup> The rate constants of fluorescence radiative decay (S<sub>1</sub> $\rightarrow$ S<sub>0</sub>) ( $k_r$ ).



**Figure S4**. Absorption spectra of BTPCzBN and BTPBN and PL spectra of 5CzBN in dilute toluene solution.



**Figure S5**. Schematic illustration of proposed energy transfer mechanism of HF system under electrical excitation.<sup>5</sup>



**Figure S6.** EL performance of nondoped OLEDs based on BTPCzBN and BTPBN. (a) electroluminescence spectra at 1000 cd m<sup>-2</sup>; (b) voltage-luminance-current density characteristics; (c) external quantum efficiency (EQE)-luminance curves; (d) current efficiency (CE)- and power efficiency (PE)-luminance curves.



Figure S7.EL curves for (a)BTPCzBN and BTPBN at different luminances.



**Figure S8.** EL performance of non-sensitized OLEDs based on BTPCzBN. (a) EL spectra at 1000 cd m<sup>-2</sup>; (b) voltage-luminance-current density characteristics; (c) EQE-luminance curves; (d) CE- and PE-luminance curves



Figure S9. EL performance of non-sensitized OLEDs based on BTPBN. (a) EL spectra at 1000 cd  $m^{-2}$ ; (b) voltage-luminance-current density characteristics; (c)

EQE-luminance curves; (d) CE- and PE-luminance curves



**Figure S10.** EL performance of non-sensitized OLED using 10 wt% 5CzBN as the dopant. (a) EL spectra at 1000 cd  $m^{-2}$ ; (b) voltage-luminance-current density characteristics; (c) EQE-luminance curves; (d) CE- and PE-luminance curves



**Figure S11.** The transient electroluminescence decay curves of (a) BTPCzBN and (b) BTPBN-based OLED devices (Binary: host/emitter; Ternary: host/assistant/emitter).



**Figure S12.** The PL spectra of 1 wt% doped non-sensitized/sensitized films of (a) BTPCzBN and (b) BTPBN.

BTPCzBN						
X [wt%]	$\lambda_{EL}{}^{a)}$ [nm]	FWHM <sup>b)</sup> [nm/eV]	CE <sup>c)</sup> [cd A <sup>-</sup> <sup>1</sup> ]	PE <sup>d)</sup> [lm W <sup>-</sup> 1]	EQE <sup>e)</sup> [%]	CIE <sup>f)</sup> (x, y)
1	496	32/0.13	50.7	53.1	20.9/17.4/12.7	(0.15, 0.52)
3	497	32/0.13	50.9	50.9	24.2/13.6/10.3	(0.11, 0.51)
BTPBN						
1	504	36/0.15	47.29	47.93	20.4/5.2/3.7	(0.25, 0.60)
3	508	42/0.16	34.6	35.07	12.5/2.8/1.7	(0.26, 0.64)

Table S7. Summary of the EL data of BTPCzBN- and BTPBN-based devices.

<sup>a)</sup> Peak wavelength of the EL spectrum; <sup>b)</sup> full-width at half-maximum of the EL spectrum; <sup>c)</sup> maximum current efficiency; <sup>d)</sup> maximum power efficiency; <sup>e)</sup> maximum external quantum efficiency, and values at 100 and 1000 cd m<sup>-2</sup>. f) CIE coordinates with luminance of 100 cd m<sup>-2</sup>.

### Reference

- 1. K. Masui, H. Nakanotani and C. Adachi, *Org. Electron.*, 2013, **14**, 2721-2726.
- K. C. Pan, S. W. Li, Y. Y. Ho, Y. J. Shiu, W. L. Tsai, M. Jiao, W. K. Lee, C. C. Wu, C. L. Chung, T. Chatterjee, Y. S. Li, K. T. Wong, H. C. Hu, C. C. Chen and M. T. Lee, *Adv. Funct. Mater.*, 2016, 26, 7560-7571.
- 3. Y. Liu, X. Xiao, Y. Ran, Z. Bin and J. You, *Chem. Sci.*, 2021, **12**, 9408-9412.
- 4. Y. T. Lee, C. Y. Chan, M. Tanaka, M. Mamada, K. Goushi, X. Tang, Y. Tsuchiya, H. Nakanotani and C. Adachi, *Adv. Opt. Mater.*, 2022, **10**.202200682
- 5. H. Nakanotani, T. Higuchi, T. Furukawa, K. Masui, K. Morimoto, M. Numata, H. Tanaka, Y. Sagara, T. Yasuda, and C. Adachi, *Nat. Commun.*, 2014, **5**, 4016.