

Supporting Information

Photosensitive-type CPL Response Controlled by Intermolecular Dynamic FRET and Chiral Transfer in Ternary Chiral Emissive Nematic Liquid Crystals

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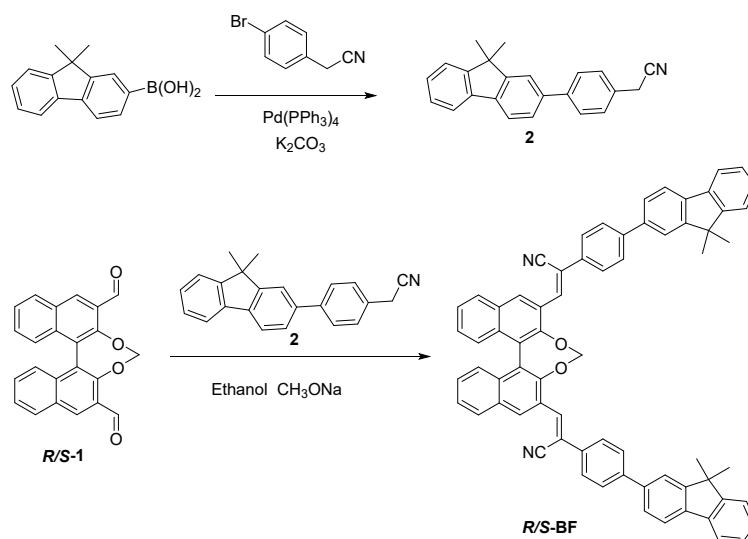
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Materials: All chemicals and reagents were purchased from Aladdin, Alfa Aesar and used as received without further purification. Nematic liquid crystal E7 ($n_e = 1.741$, $n_o = 1.517$, at 589 nm; $T_m = -40^\circ\text{C}$, $T_i = 59^\circ\text{C}$) and was purchased from Suzhou King Optonics Co. Ltd. The LC cells were purchased from Suzhou King Optonics CO. Ltd.

Characterizations: The ^1H NMR (400 MHz) and ^{13}C NMR (100 MHz) spectra were recorded on a 400 MHz Bruker AVANCE III-400 spectrometer by using CDCl_3 as solvent and the TMS as internal standard. Fluorescence (FL) spectra were measured by using a HORIBA Scientific Fluoromax-4 Spectrofluorometer. The UV-visible (UV-vis) absorption spectra were recorded Hitachi U-3900 spectrophotometer. Circular dichroism (CD) spectra and circularly polarized luminescence (CPL) spectra were recorded by using JASCO J-810 spectropolarimeter and JASCO CPL-300 spectrofluoropolarimeter in quartzose cells (the thickness of the LC cell is 15 μm), respectively. Fluorescence lifetime measurements were recorded on Edinburg FLS-980 fluorescence spectrometer.

Synthesis of the *R/S*-BF.

Intermediate *R/S*-1 were prepared as our previously described.^{S1}



Scheme S1. The synthesis procedures of *R/S*-BF enantiomers.

Compound 2: Intermediate **2** was synthesized from (9,9-Dimethyl-9H-fluoren-2-yl)boronic acid (2.00 g, 8.39 mmol), 4-Bromophenylacetonitrile (1.97 g, 10.08 mmol), $\text{Pd}(\text{PPh}_3)_4$ (0.18 g, 0.16 mmol) and K_2CO_3 (1.74 g, 12.56 mmol) in a mixture solvent of 30 mL 1,4-Dioxane and 10 ml H_2O at 85 °C under N_2 atmosphere for 12 h. After the reaction was finished, the mixture was poured into water and extracted with CH_2Cl_2 (30 ml \times 3). The organic layer was dried with anhydrous sodium sulfate and filtrated. Then evaporated under reduced pressure. The crude product was purified with silica gel colum chromatography (eluent: petroleum ether/ethyl acetate, v/v, 4:1) to give 2.08 g of **2** (yellow solid in 80 % yeild) ^1H NMR (400 MHz, CDCl_3) δ 7.80-7.78 (d, J = 8 Hz, 1H), 7.76-7.74 (dd, J = 8 Hz, 1H), 7.69-7.66 (d, J = 12 Hz, 2H), 7.63 (s, 1H), 7.57-7.55 (dd, J = 8 Hz, 1H), 7.47-7.41 (m, 3H), 7.36-7.33 (m, 2H), 3.82 (s, 2H), 1.54 (s, 6H). ^{13}C NMR (100 MHz, CDCl_3) δ 154.37, 153.87, 141.54, 139.31, 138.90, 138.68, 128.65,

128.37, 127.89, 127.42, 127.08, 126.14, 122.64, 121.32, 120.37, 120.15, 46.99, 27.23, 23.37.

Compound *R/S*-BF: Compound **2** (0.30 g, 0.97 mmol) and ***R/S*-1** (0.17 g, 0.49 mmol) were dissolved in 20 mL ethanol and CH₃ONa (0.052 g, 0.97 mmol) were added, respectively. Then stirred at room temperature for 3 h. After the reaction was finished, the product was purified by recrystallization from ethanol to give compound ***R/S*-BF** as a yellow solid (0.28 g) in 62% yield. ¹H NMR (400 MHz, CDCl₃) δ 8.98 (s, 2H), 8.14-8.11 (t, *J* = 12 Hz, 4H), 7.88-7.86 (d, *J* = 8Hz, 4H), 7.82-7.76 (m, 8H), 7.69 (s, 2H), 7.64-7.62 (d, *J* = 8 Hz, 2H), 7.57-7.53 (t, *J* = 16 Hz, 2H), 7.48-7.45 (m, 4H), 7.42-7.38 (t, *J* = 16 Hz, 2H), 7.37-7.33 (m, 4H), 5.73 (s, 2H), 1.55 (s, 12H). ¹³C NMR (100 MHz, CDCl₃) δ 154.66, 153.91, 148.87, 142.86, 139.21, 138.95, 138.61, 135.37, 133.10, 132.86, 131.24, 129.76, 129.60, 127.82, 127.54, 127.11, 126.70, 126.14, 126.09, 122.67, 121.29, 120.47, 120.21, 113.66, 47.01, 27.23.

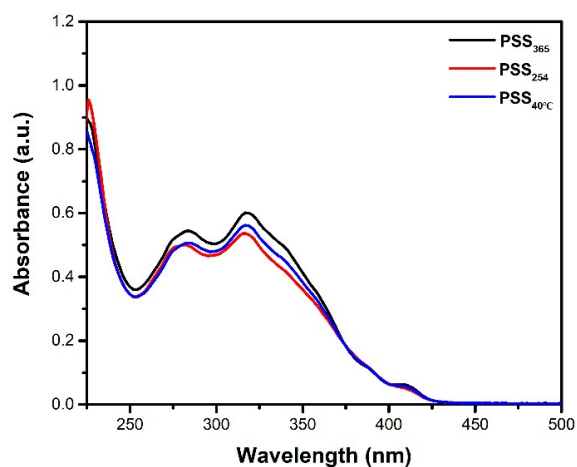


Fig. S1. UV-*vis* absorption spectra of *S*-BF in THF solution (1.0×10^{-5} mol L⁻¹) with different states.

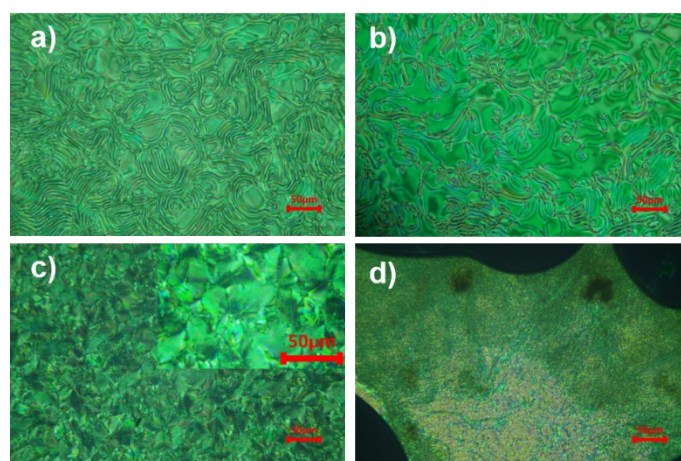


Fig. S2. POM images of a) 0.25 wt% *S*-BF in E7 LCs before 365 nm UV irradiation at 25 °C. b) 0.25 wt% *S*-BF in E7 LCs after 365 nm UV irradiation at 25 °C. c) 1.0 wt% *S*-BF in E7 LCs before 365 nm UV irradiation at 25 °C. d) 1.0 wt% *S*-BF in E7 LCs after 365 nm UV irradiation at 25 °C.

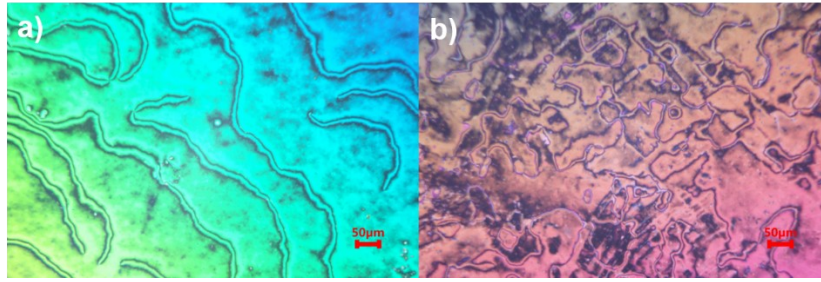


Fig. S3. POM images of a) 0.5 wt% NR in E7 LCs. b) 1.0 wt% NR in E7 LCs.

The energy transfer efficiencies can be assessed from steady-state fluorescence spectrums by using the **Equation S1** as shown in Figure S4. The F_D and F_{DA} are defined the maximum fluorescence intensity of Donor in the absence and presence of acceptor, respectively.^{S2}

$$E = 1 - \frac{F_D}{F_{DA}} \quad \text{(Equation S1)}$$

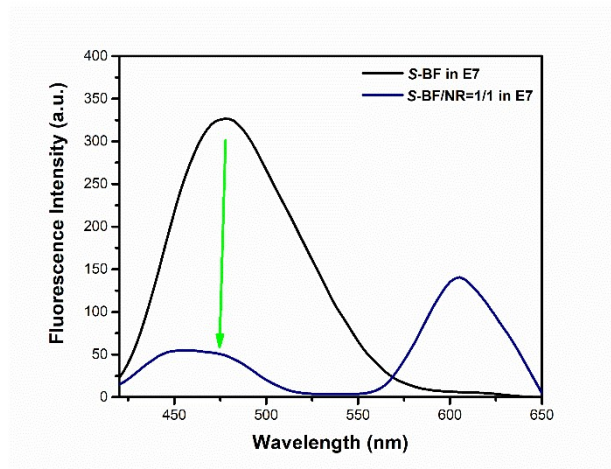


Fig. S4. The energy transfer efficiency (83%) of Z-S-T-N*-LCs in the cases of 1/1 ratio of NR/S-BF (λ_{ex} = 370 nm).

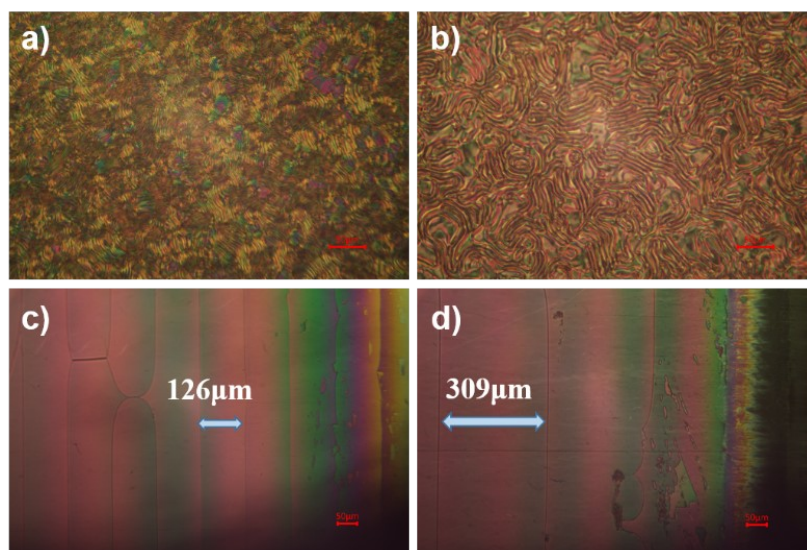


Fig. S5. a) POM images of *S-T-N**-LCs before 365 nm UV irradiation at 25 °C. b) POM images of *S-T-N**-LCs after 365 nm UV irradiation at 25 °C. c) The Grandjean-Cano lines of *S-T-N**-LCs before 365 nm UV irradiation at 25 °C. d) The Grandjean-Cano lines of *S-T-N**-LCs after 365 nm UV irradiation at 25 °C.

References

[S1] X. Li, Y. Shen, K. Liu, Y. Quan and Y. Cheng, *Mater. Chem. Front.*, 2020, **4**, 2954-2961.

[S2] S. Lin, H. Sun, J. Qiao, X. Ding and J. Guo, *Adv. Optical Mater.*, 2020, **8**, 2000107.