

Supporting Information

Helical Fibers with Circularly Polarized Luminescence via Ionic Linkage of Binaphthol and Tetraphenylethylene Derivatives

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Figure S20. Aggregation-induced luminescence property of **RBNP-TPEHN**. **RBNP-TPEHN**

was dissolved in mixed solution of DMF / water at a concentration of 5×10^{-6} M (DMF, 50%, 70%, 80%, 90%, 95%). Excitation wavelength: 320 nm.

Figure S21. Aggregation-induced luminescence property of **SBNP-TPEHN**. **SBNP-TPEHN** was dissolved in mixed solution of DMF/water at a concentration of 5×10^{-6} M (DMF, 50%, 70%, 80%, 90%, 95%). Excitation wavelength: 320 nm.

Figure S22. Structural simulation of **RBNP-TPEHN** molecule DFT calculations B3LYP/6-31G* level in Gaussian 03 program.

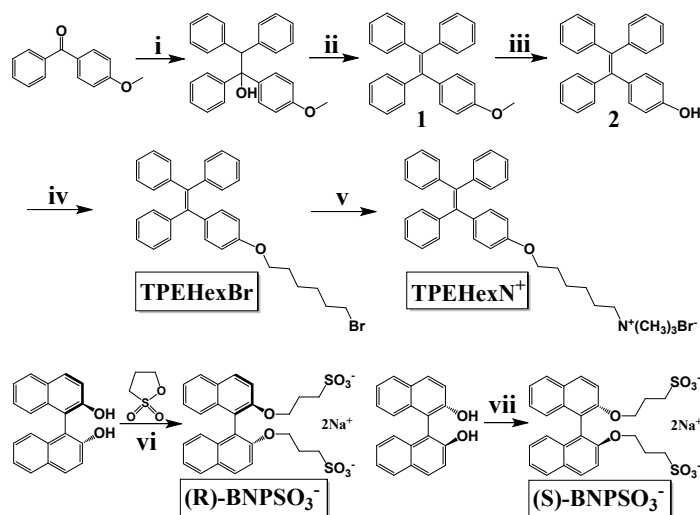
Figure S23. TEM images of **RBNP-TPEHN** assemblies. SEM analysis was performed on silicon wafer substrates after naturally evaporation of 0.02 mg/mL drops of **RBNP-TPEHN** assemblies in chloroform/ethanol mixture (9:1, v/v). Scale bar: a) 500 nm; b) 100 nm; c) 50 nm.

Figure S24. TEM images of **SBNP-TPEHN** assemblies. SEM analysis was performed on silicon wafer substrates after naturally evaporation of 0.02 mg/mL drops of **SBNP-TPEHN** assemblies in chloroform/ethanol mixture (9:1, v/v). Scale bar: a) 500 nm; b) 100 nm; c) 50 nm.

Figure S25. XRD patterns of **RBNP-TPEHN** (a) and **SBNP-TPEHN** (b) assemblies as cast films on silicon wafer substrates.

Synthesis

TPEHexN⁺ and **R-/S-BNPSO₃⁻** were synthesized according to Scheme S1. The chemical structures of all the precursors and ionic compounds were identified via NMR spectra, which were shown in Figure S1-7.



Scheme S1. Synthetic routes for ionic compounds **TPEHexN⁺** and **R-/S-BNPSO₃⁻**. ^a Conditions: (i) n-BuLi, THF, -5 °C, 12 h, (ii) p-toluene sulfonic acid, toluene, reflux, overnight, (iii) borontribromide, DCM, -78 °C, 12h, (iv) 1,6-dibromo hexane, K₂CO₃, DMF, 90 °C, 24 h, (v) trimethylamine, THF, 24 h, (vi) and (vii) 1,3-propanesultone, NaOH, ethyl alcohol, 100 °C, 2h.

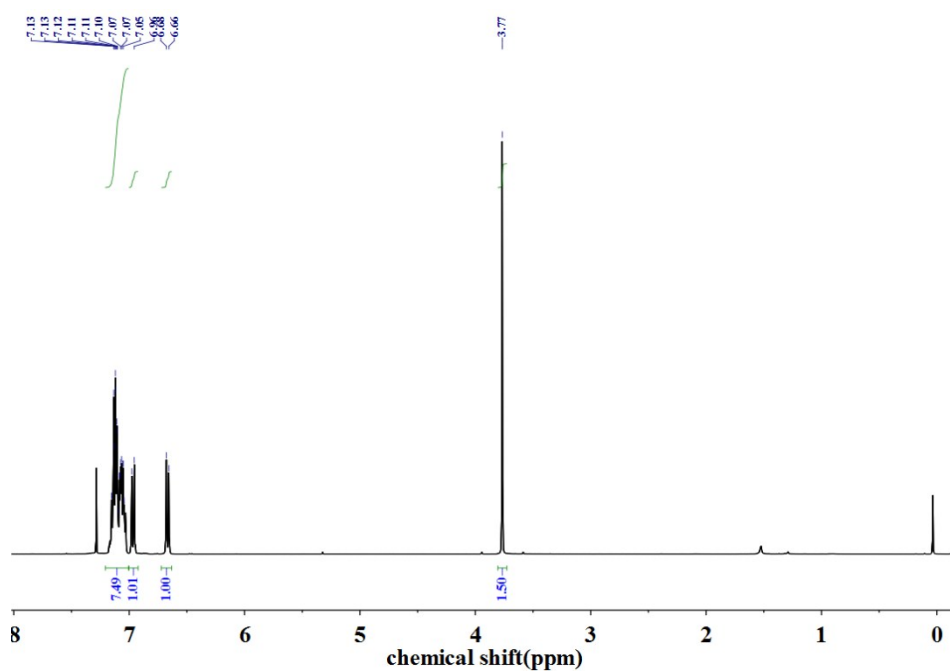


Figure S1. ¹H NMR spectrum of 4-methoxy tetraphenylethylene (compound 1).

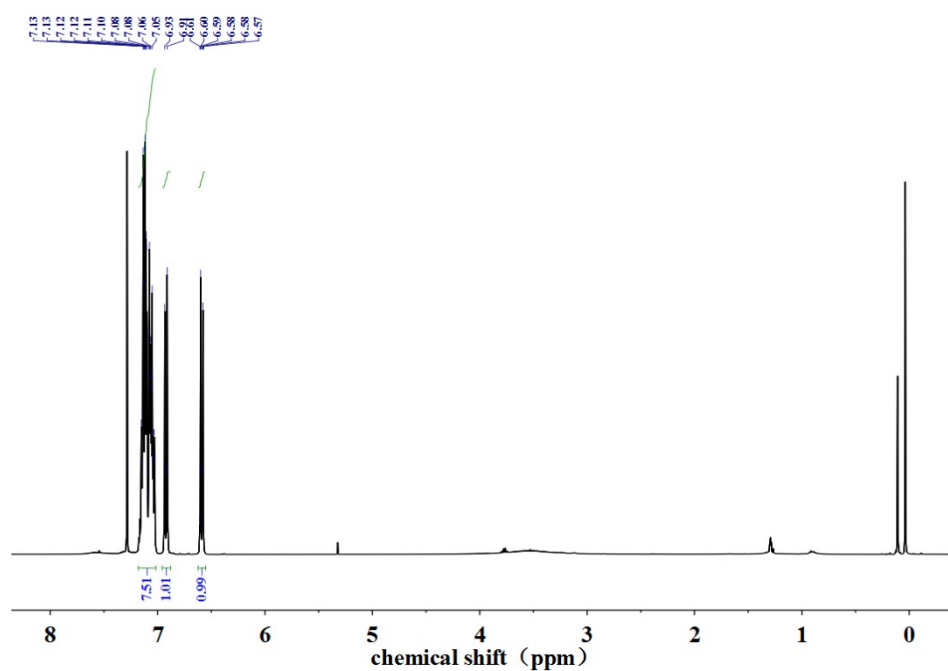


Figure S2. ¹H NMR spectrum of 4-hydroxy tetraphenylethylene (compound 2).

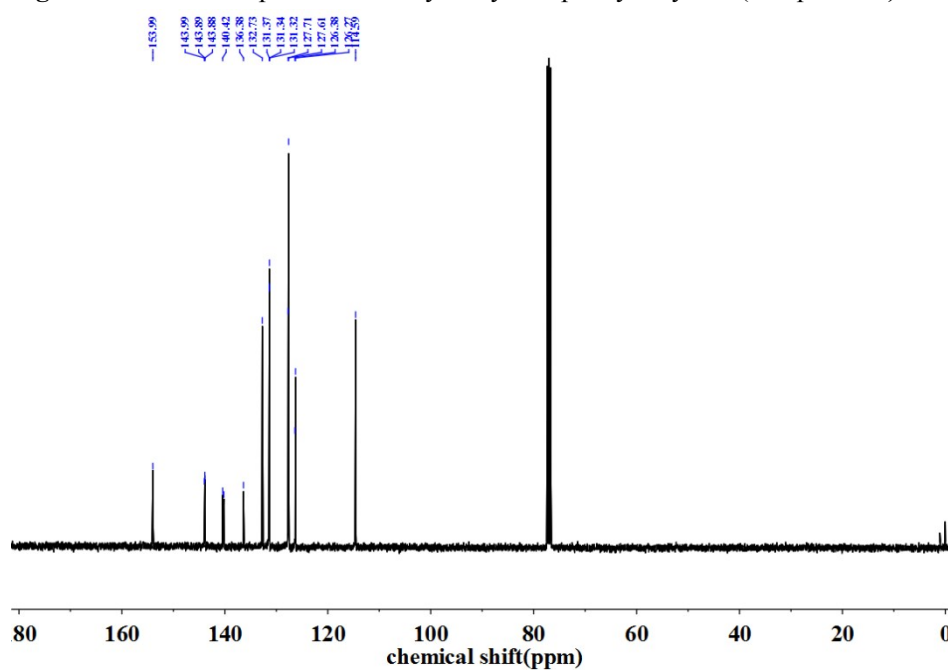


Figure S3. ¹³C NMR spectrum of 4-hydroxy tetraphenylethylene (compound 2).

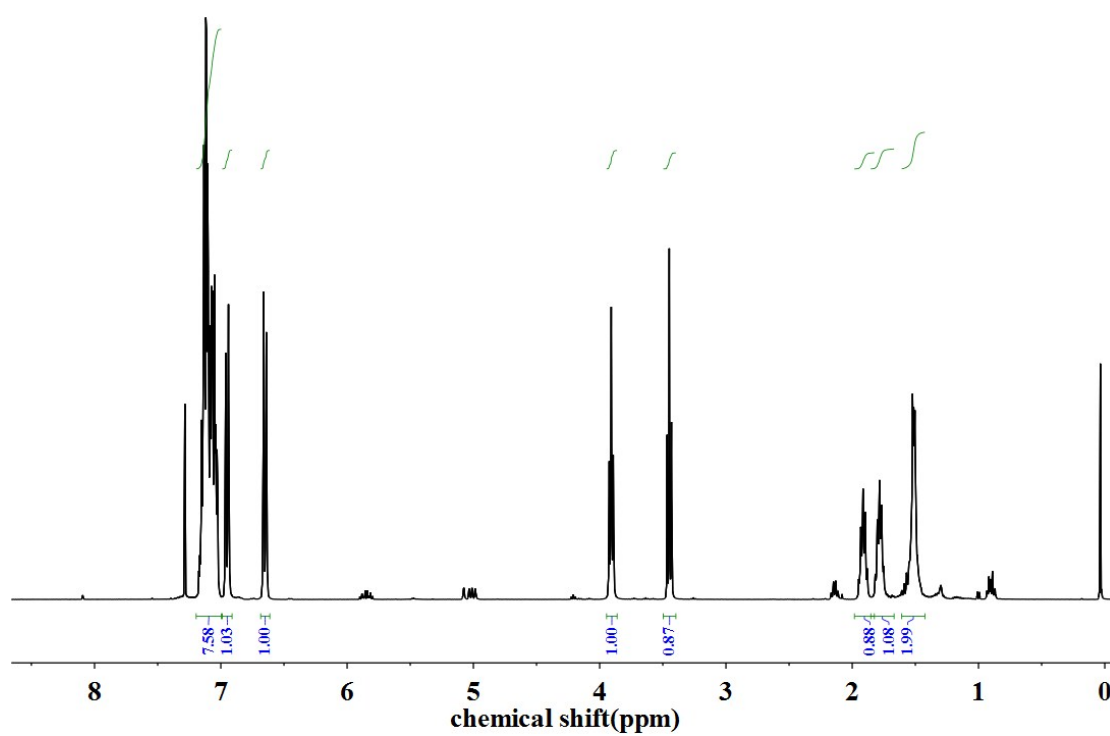


Figure S4. ¹H NMR spectrum of compound TPEHBr.

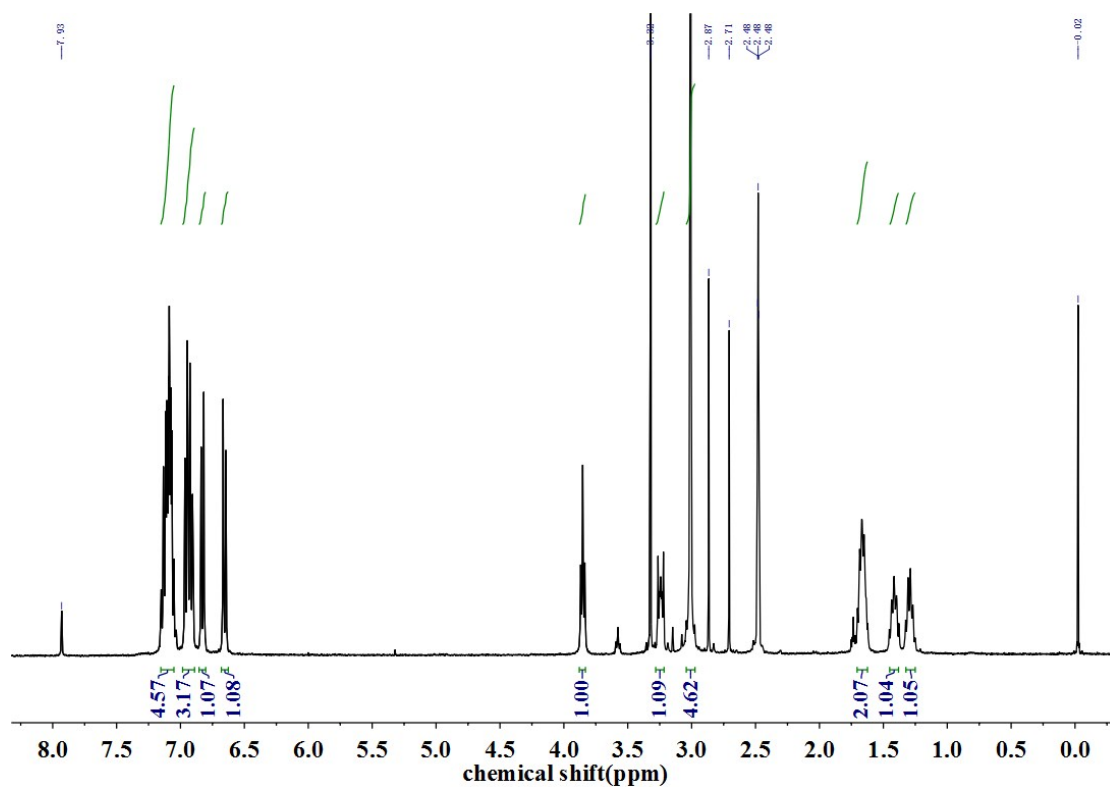


Figure S5. ¹H NMR spectrum of compound TPEHN⁺.

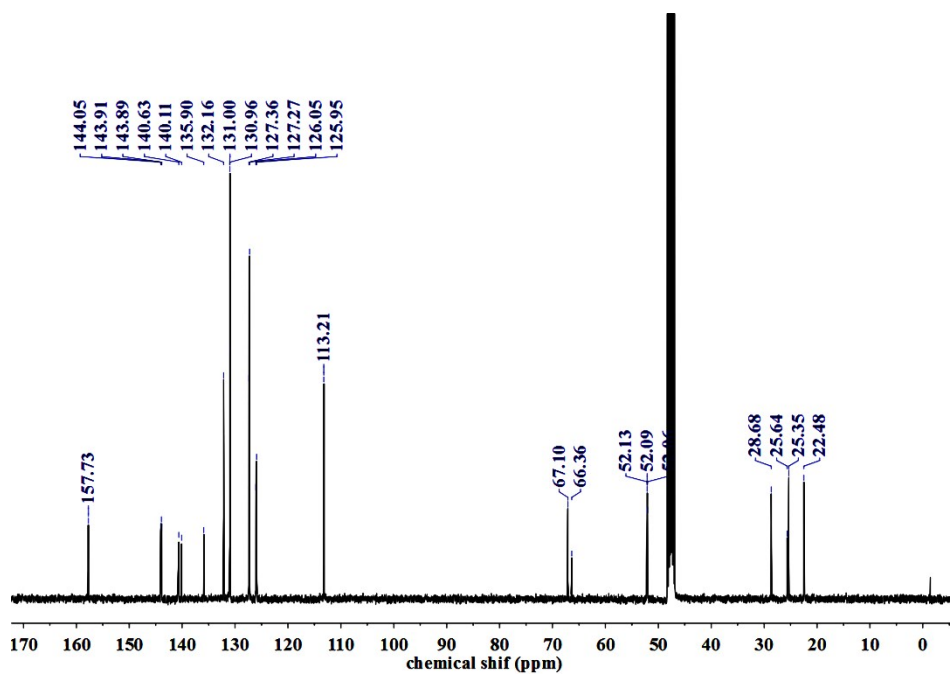


Figure S6. ¹³C NMR spectrum of compound TPEHN⁺.

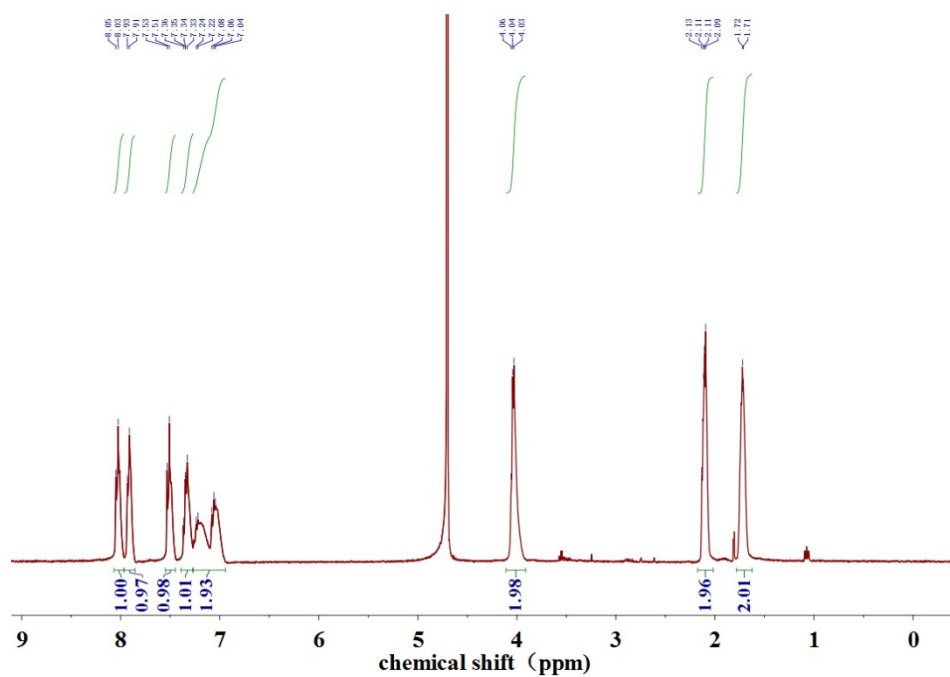


Figure S7. ¹H NMR spectrum of compound (R)-BNPSO₃⁻.

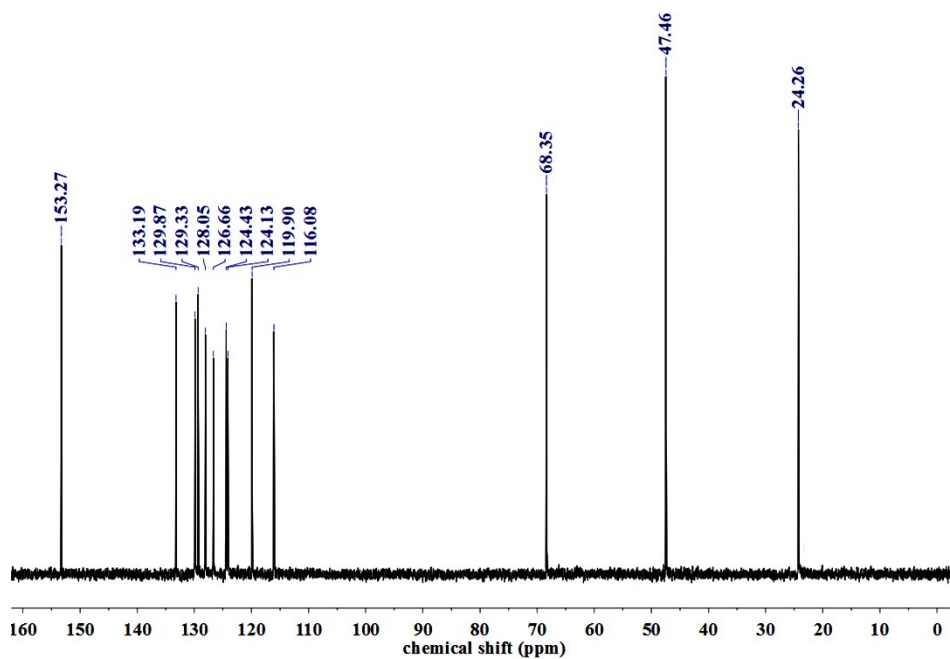


Figure S8. ¹³C NMR spectrum of compound (R)-BNPSO₃⁻.

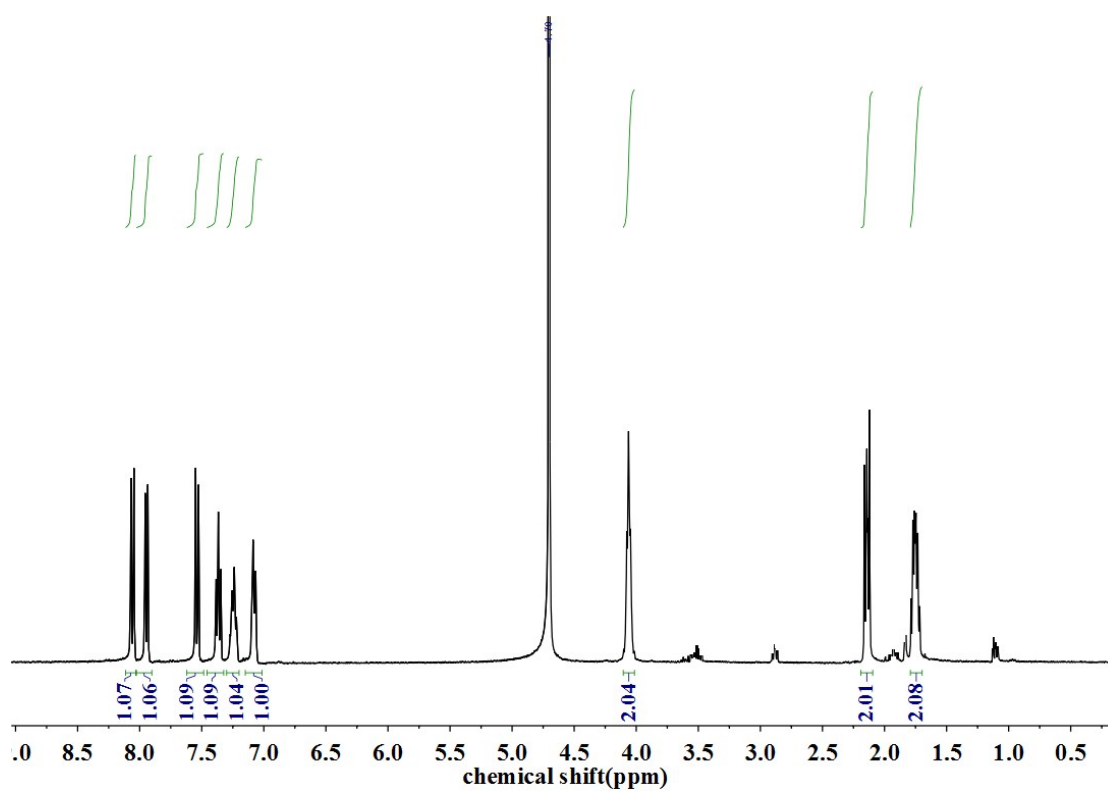


Figure S9. ¹H NMR spectrum of compound (S)-BNPSO₃⁻.

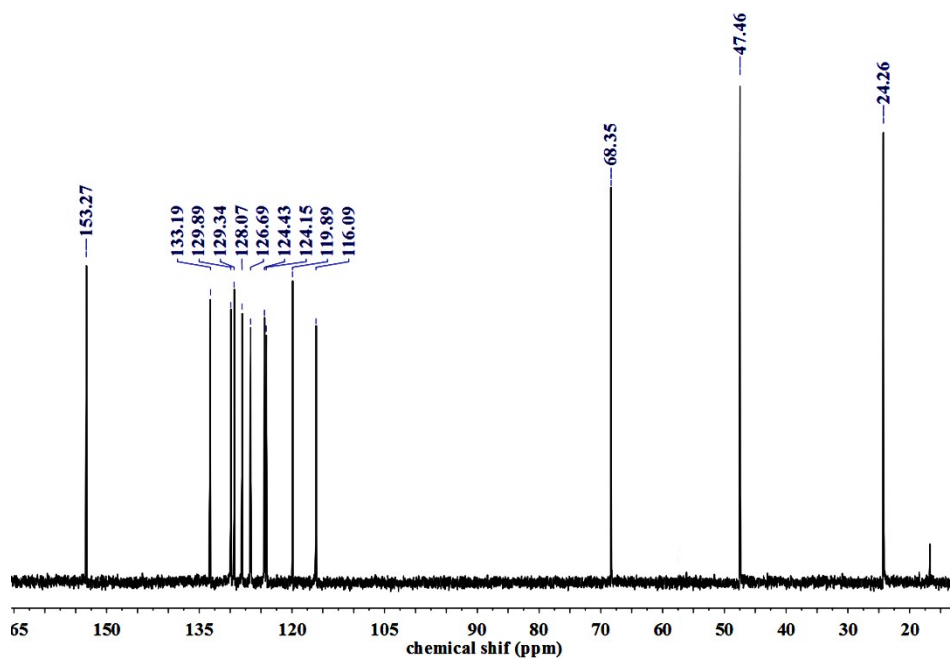


Figure S10. ¹³C NMR spectrum of compound (S)-BNPSO₃⁻.

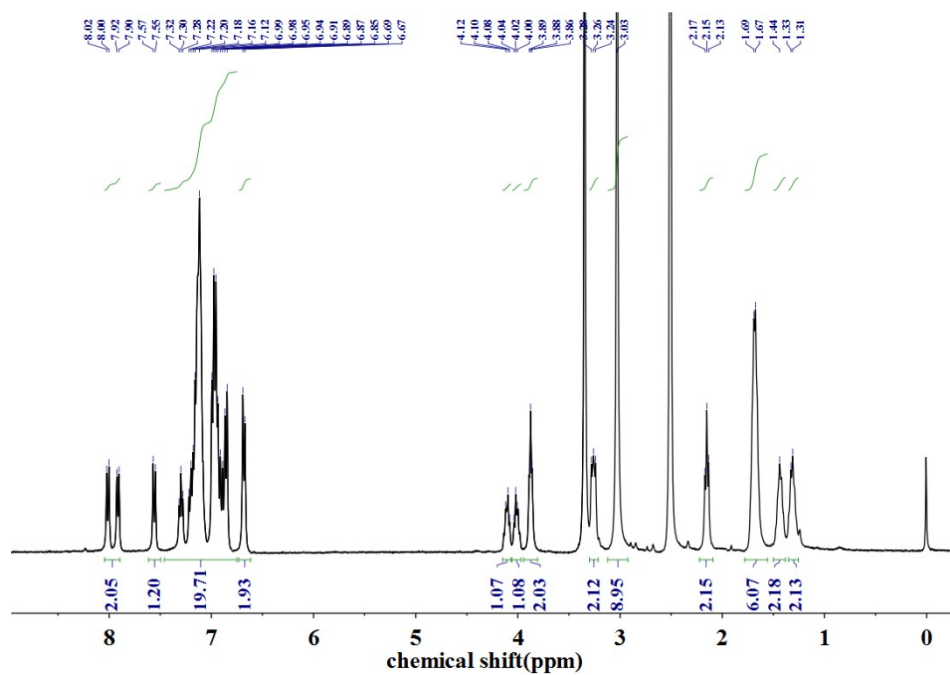


Figure S11. ¹H NMR spectrum of compound RBNP-TPEHN.

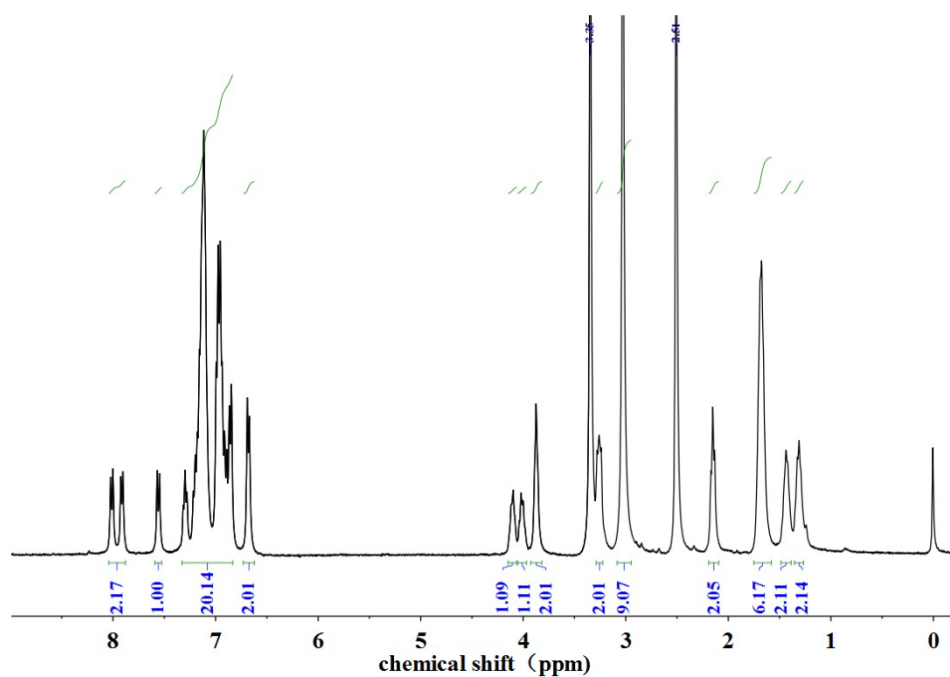


Figure S12. ^1H NMR spectrum of compound SBNP-TPEHN.

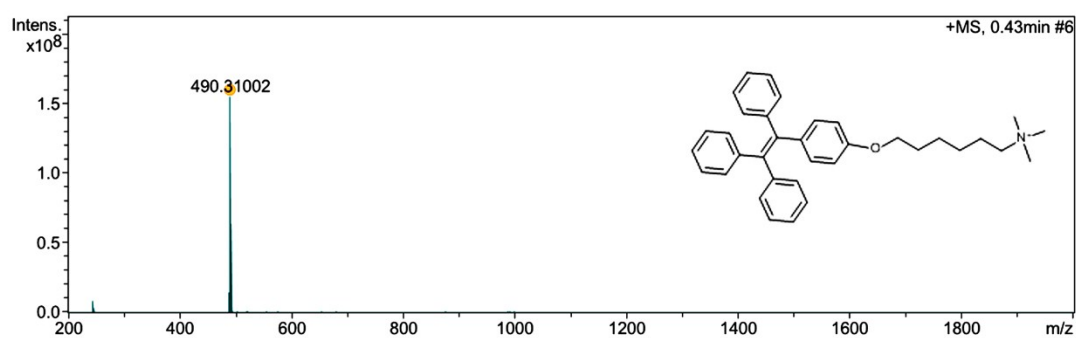


Figure S13. HRMS spectrum of compound TPEHN $^+$.

Characterization of RBNP-TPEHN and RBNP-TPEH

The ^1H NMR and FTIR spectra of obtained **SBNP-TPEHN** and **RBNP-TPEH** assemblies were presented in Figure S10 and Figure 1, respectively.

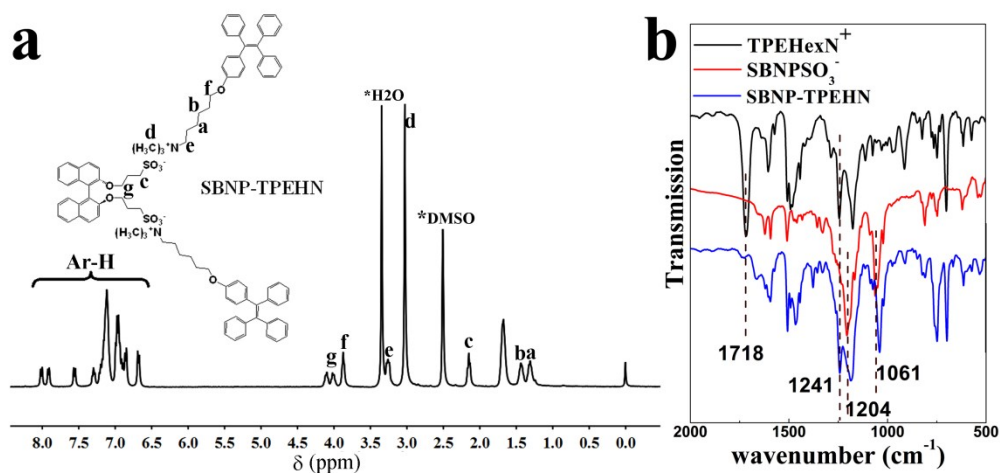


Figure S14. a) ^1H NMR spectrum of SBNP-TPEHN assembly; b) FT-IR spectra of TPEHN $^+$, S-BNPSO $_3^-$ and SBNP-TPEHN assembly in KBr pellets.

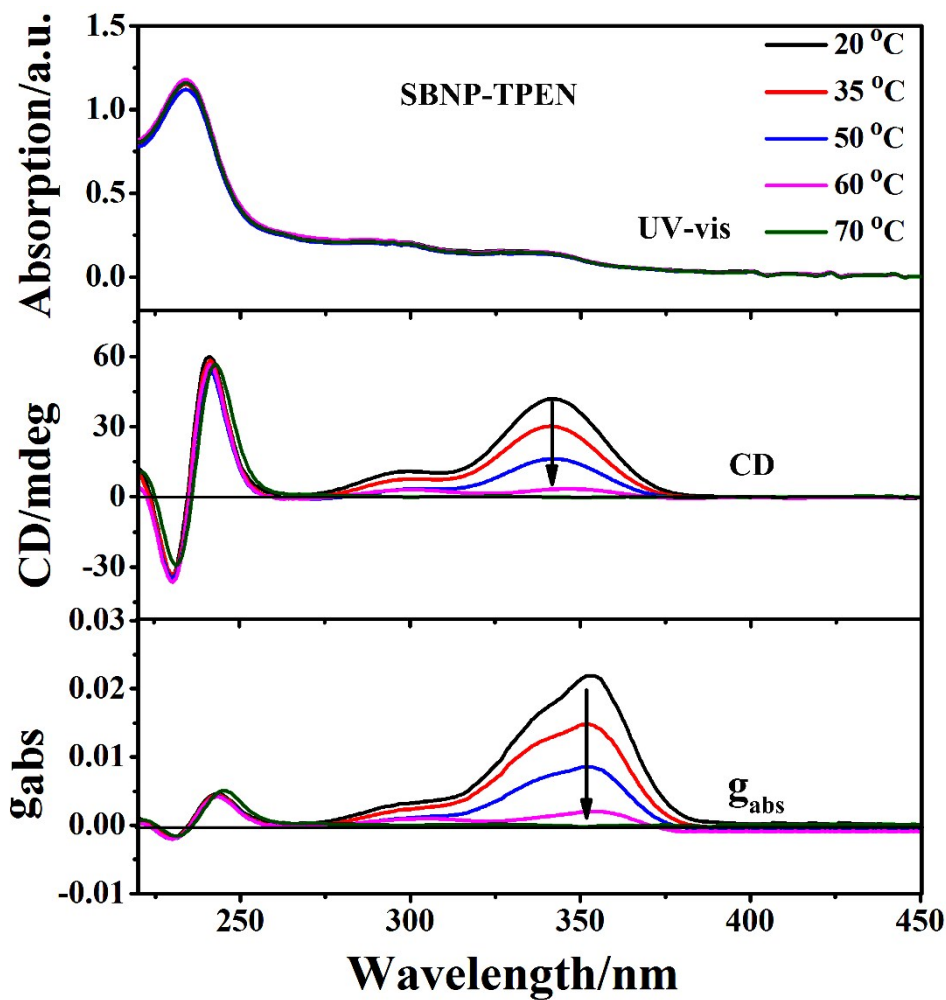


Figure S15. The UV-vis absorption, CD, and gabs spectra of SBNP-TPEHN in methanol / water (v/v=1:10) with a concentration of 5×10^{-6} M at various temperatures.

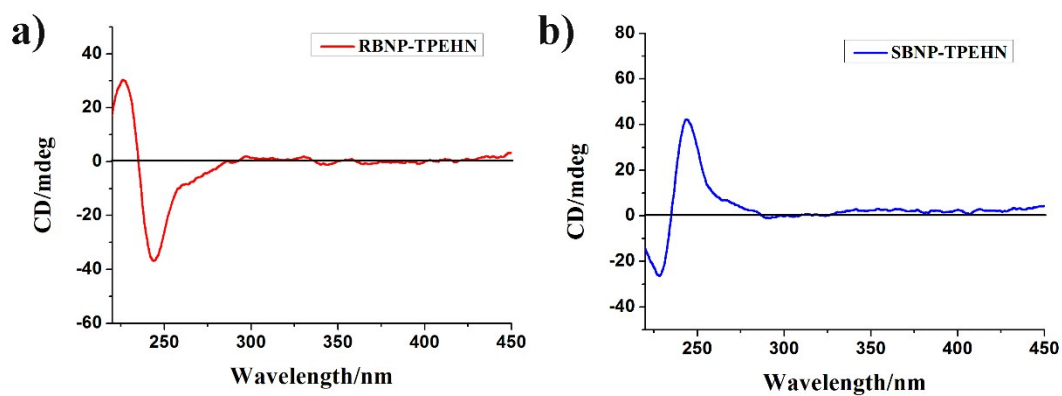


Figure S16. CD spectra of **RBNP-TPEHN** and **SBNP-TPEHN** in methanol solution with a concentration of 3×10^{-6} M.

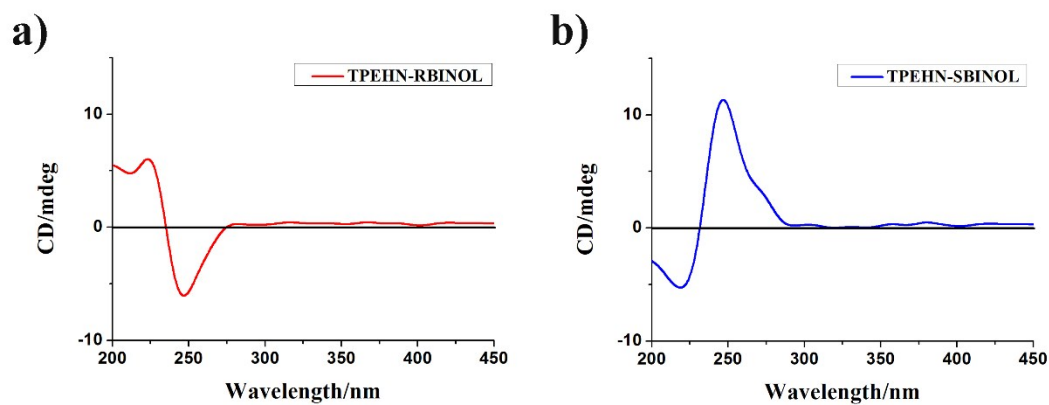


Figure S17. CD spectra of **TPEHN** mixed with (R)- or (S)-1,1'-bi-2-naphthol film. The film prepared by dropping 2 mg / ml DCM mixture of **TPEHN** and (R)- or (S)-1,1'-bi-2-naphthol (mol /mol=2:1) on silicon wafer substrates after solvent evaporation.

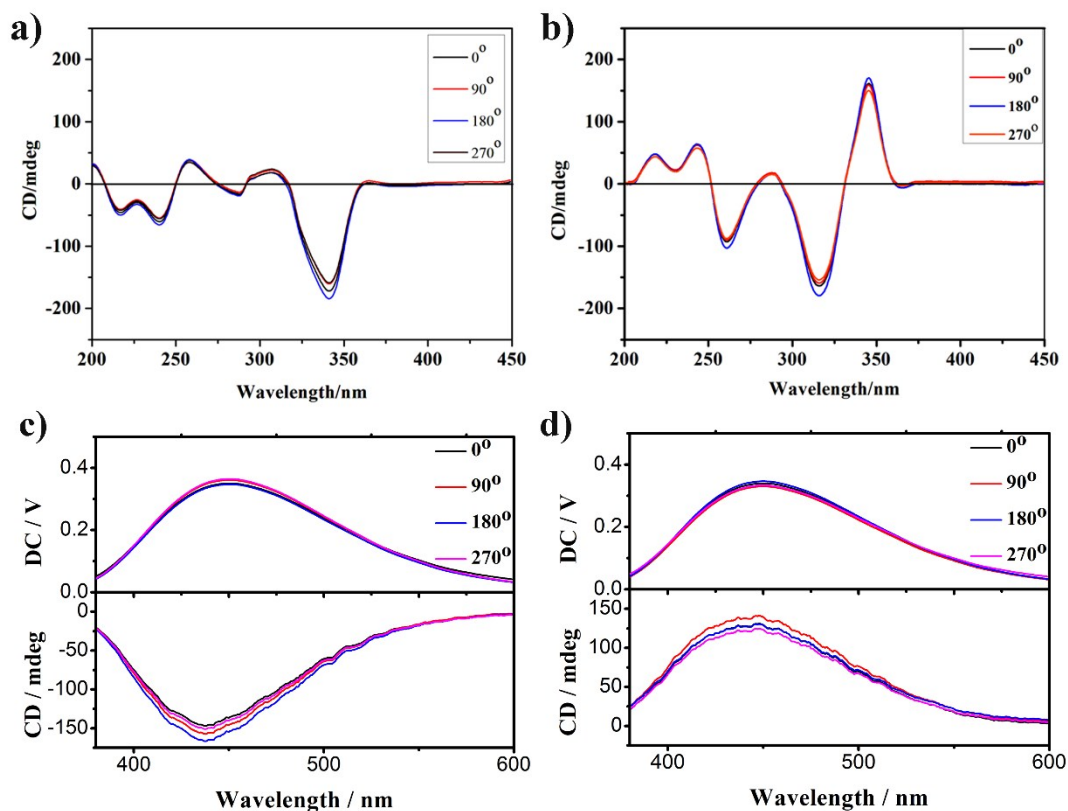


Figure S18. CD/CPL and PL spectra of **RBNP-TPEHN** (a)/(c) and **SBNP-TPEHN** (b)/(d) at different rotation angles.

Optical properties

The optical properties of **RBNP-TPEHN** and **SBNP-TPEHN** as cast films were studied using UV/vis and photoluminescence (PL) spectroscopies. The cast films were prepared by dissolving **RBNP-TPEHN** and **SBNP-TPEHN** assemblies in mixture of chloroform/ethanol (v/v=9/1) at a concentration of 0.5 mg/mL, then casting on quartz plates and being dried by natural evaporation.

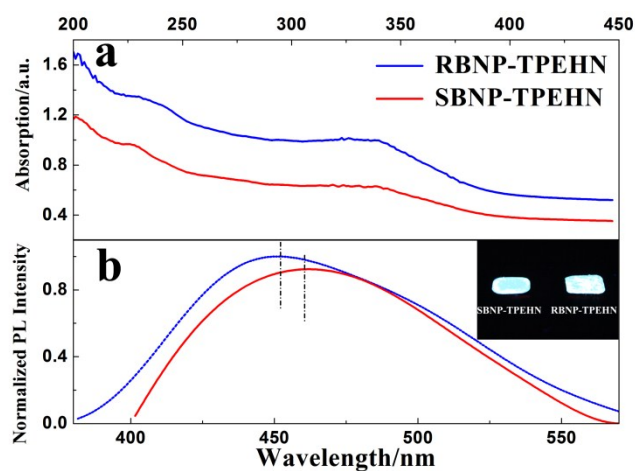


Figure S19. UV/vis absorption (a) and normalized photoluminescence (b) spectra of **RBNP-TPEHN** (blue) and

SBNP-TPEHN (red) in solid state. Excitation wavelength: 340 nm. (Inset image: luminescence photos of **RBNP-TPEHN** (right) and **SBNP-TPEHN** (left) assemblies cast on silicon quartz when exposed to UV lamp of 365 nm.)

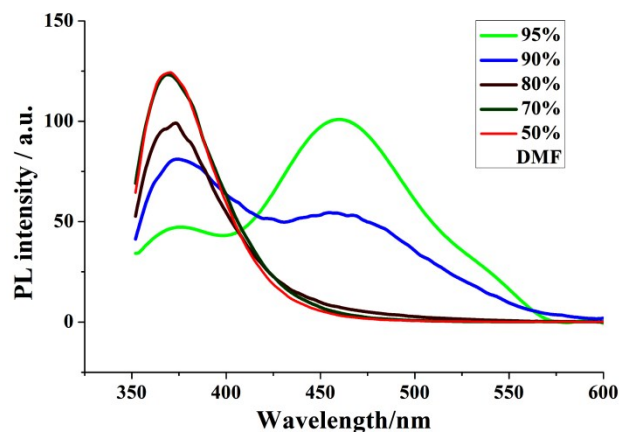


Figure S20. Aggregation-induced luminescence property of **RBNP-TPEHN**, which was dissolved in mixed solution of DMF / water at a concentration of 5×10^{-6} M (DMF, 50%, 70%, 80%, 90%, 95%). Excitation wavelength: 320 nm.

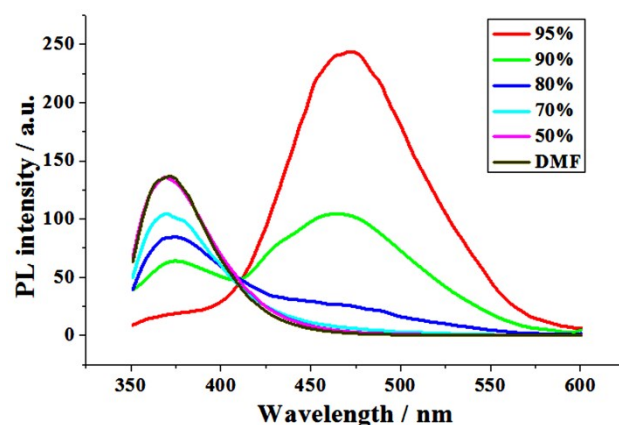


Figure S21. Aggregation-induced luminescence property of **SBNP-TPEHN**, which was dissolved in mixed solution of DMF/water at a concentration of 5×10^{-6} M (DMF, 50%, 70%, 80%, 90%, 95%). Excitation wavelength: 320 nm.

Figure S15a showed the UV/vis absorption spectra of **RBNP-TPEHN** (blue curve) and **SBNP-TPEHN** (red curve) as cast films. Two absorption bands, corresponding to π - π^* transition of binaphthalene moiety and π - π^* transition of TPE moiety, were clearly observed at 228 nm and 340 nm, respectively. Figure S15b presents the normalized fluorescence spectra of **RBNP-TPEHN** (blue) and **SBNP-TPEHN** (red) as cast films. Obvious emission was observed at 465 nm for **SBNP-TPEHN**, and 457 nm for **RBNP-TPEHN** cast film. The inset image of Figure S16b shows PL photo of **RBNP-TPEHN** and **SBNP-TPEHN** cast films irradiated with 365 nm UV light. Very bright green light were emitted and clearly observed from both films. The quantum

yields of **RBNP-TPEHN** and **SBNP-TPEHN** in solid state were measured by steady-state and time-resolved fluorescence spectrofluorometer and presented high values of 42% and 43%, respectively. To further verify the aggregation-induced luminescence properties, fluorescence emission spectra of **RBNP-TPEHN** and **SBNP-TPEHN** in DMF/water mixtures with different ratio were also studied (see PL spectra shown in Figure S17, S18). When the ratio of water (poor solvent) increased up to 80%, emission at 470 nm was observed in the spectra. When the ratio of water kept increasing, the PL intensities dramatically enhanced, implying **RBNP-TPEHN** and **SBNP-TPEHN** exhibited typical AIE property. These results indicated the **R- or SBNP-TPEHN** still preserves the AIE feature.

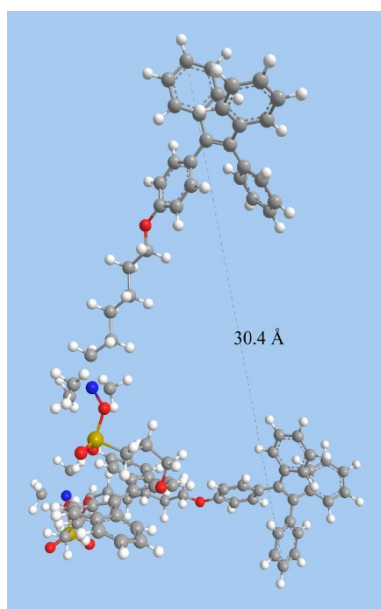


Figure S22. Structural simulation of SBNP-TPEHN molecule by DFT calculations B3LYP/6-31G* level in Gaussian 03 program.

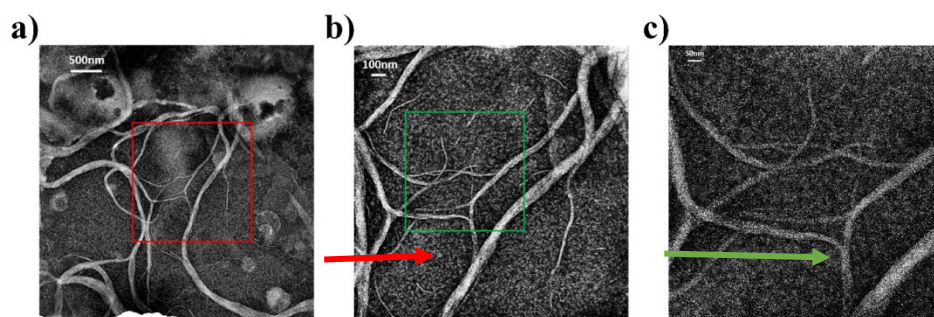


Figure S23. TEM images of **RBNP-TPEHN** assemblies. TEM analysis was performed on silicon wafer substrates after naturally evaporation of 0.02 mg/mL drops of **RBNP-TPEHN** assemblies in chloroform/ethanol mixture (9:1, v/v). Scale bar: a) 500 nm; b) 100 nm; c) 50 nm.

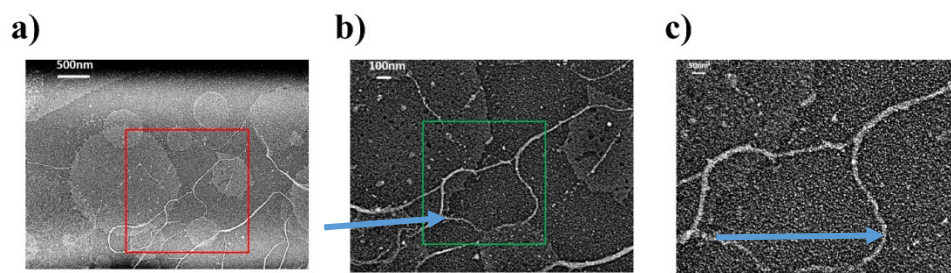


Figure S24. TEM images of **SBNP-TPEHN** assemblies. TEM analysis was performed on silicon wafer substrates after naturally evaporation of 0.02 mg/mL drops of **SBNP-TPEHN** assemblies in chloroform/ethanol mixture (9:1, v/v). Scale bar: a) 500 nm; b) 100 nm; c) 50 nm.

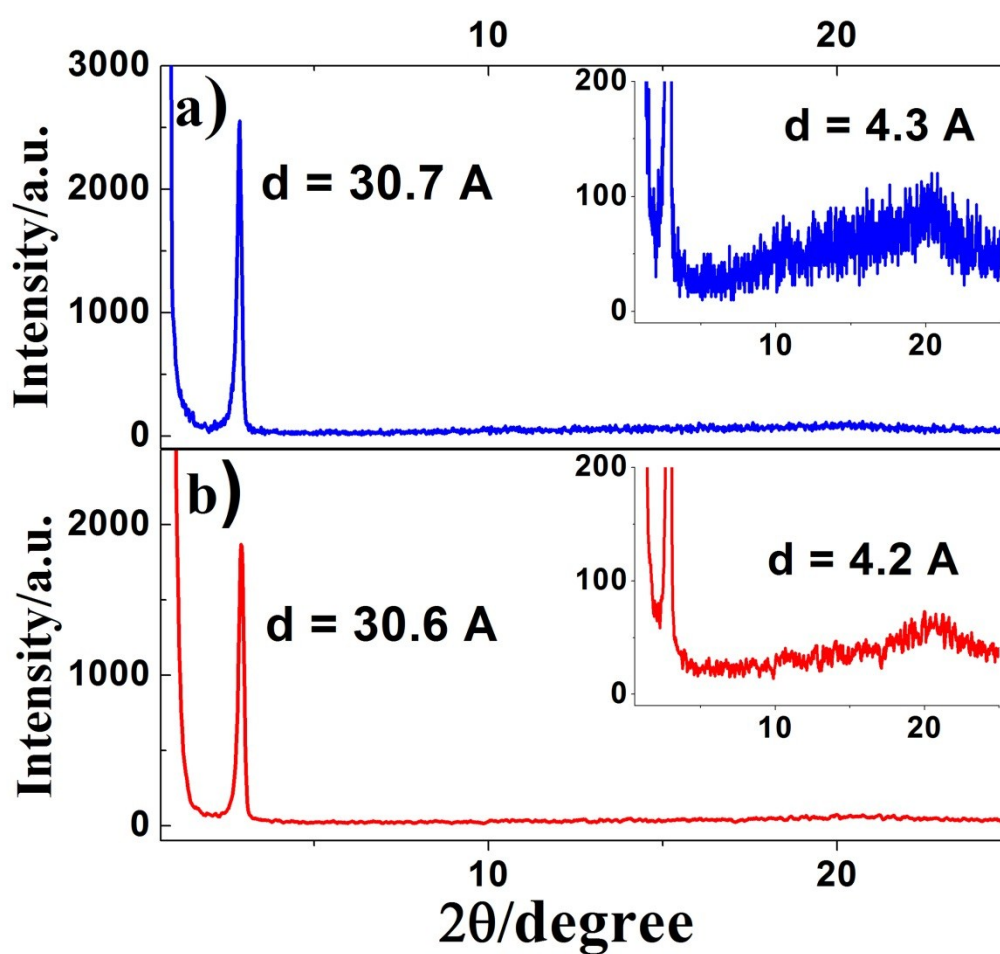


Figure S25. XRD patterns of **RBNP-TPEHN** (a) and **SBNP-TPEHN** (b) assemblies as cast films on silicon wafer substrates.