

Highly efficient polymerization via Sulfur(VI)-fluoride exchange (SuFEx): Novel polysulfates bearing a pyrazoline-naphthylamide conjugated moiety and their electrical memory performance

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Experimental section

Materials

4-bromo-1,8-naphthalic anhydride, n-Butylamine, p-hydroxybenzaldehyde, 4'-hydroxyacetophenone, imidazole, tert-butyldimethylsilyl chloride, hydrazine hydrate, bisphenol S, and 1,8-diazabicyclo[5.4.0]undec-7-ene [DBU] from TCI (Shanghai) Development Co., Ltd. were used as received without further purification. Sulfuryl fluoride (SO₂F₂) were purchased from Maui (Hangzhou) Electronic Chemicals Co., Ltd. All solvents and other reagents were purchased from Sinopharm Chemical Reagent Co., Ltd and used without further purification.

Synthesis of (E)-1, 3-bis (4-hydroxyphenyl) prop-2-en-1-one (BHPP).

4'-hydroxyacetophenone (16.32 g, 0.12 mol) was dissolved in sulfuric acid (2 mL). The solution of p-hydroxybenzaldehyde (12.2 g, 0.10 mol) in glacial acetic acid (60 mL) was added dropwise to the reaction mixture. The reaction mixture was stirred at room temperature for 24 hrs. The solution was then poured into 500 mL of ice water. The mixture was neutralized with proper amount of 1 M KOH solution. The resulting precipitate was filtered and the crude product was recrystallized twice in ethanol. The BHPP was finally isolated as a yellow powder (20 g, 83.3%). mp: 197-199 °C. ¹H NMR (400 MHz, DMSO-*d*₆) δ (ppm) 10.34 (s, 1H), 10.03 (s, 1H), 8.04 (d, J = 8.1 Hz, 2H), 7.75–7.64 (m, 3H), 7.61 (d, J = 15.3 Hz, 1H), 6.88 (d, J = 8.1 Hz, 2H), 6.83 (d, J = 8.0 Hz, 2H). ¹³C NMR (151 MHz, DMSO-*d*₆) δ (ppm) 187.48, 162.32, 160.25, 143.59, 131.36, 131.14, 129.89, 126.42, 118.97, 116.21, 115.73.

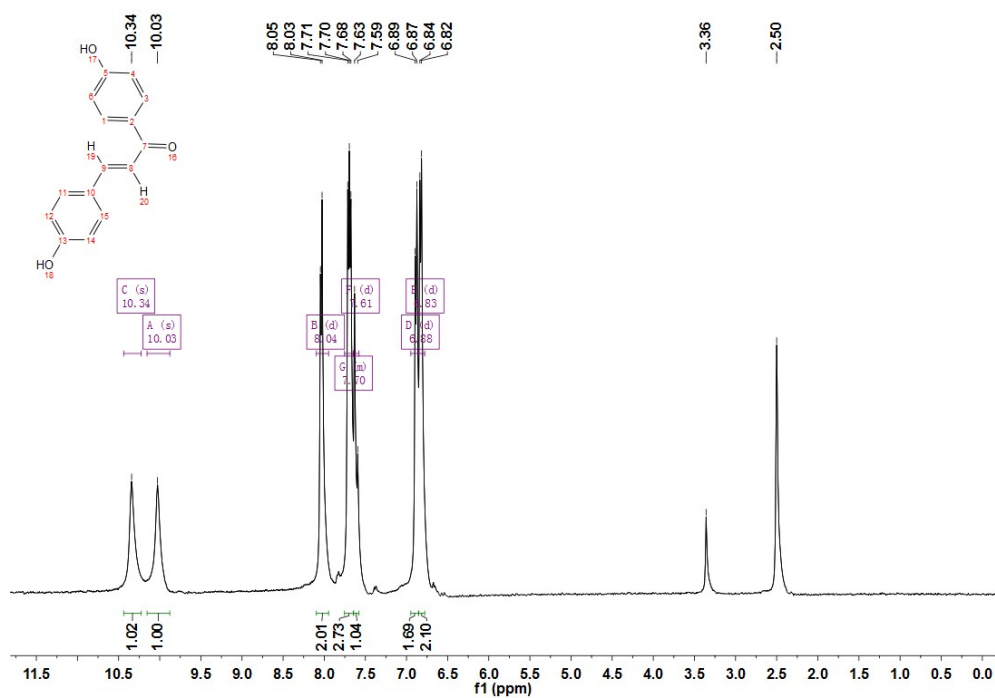


Figure S1a. ¹H NMR spectrum of BHPP.

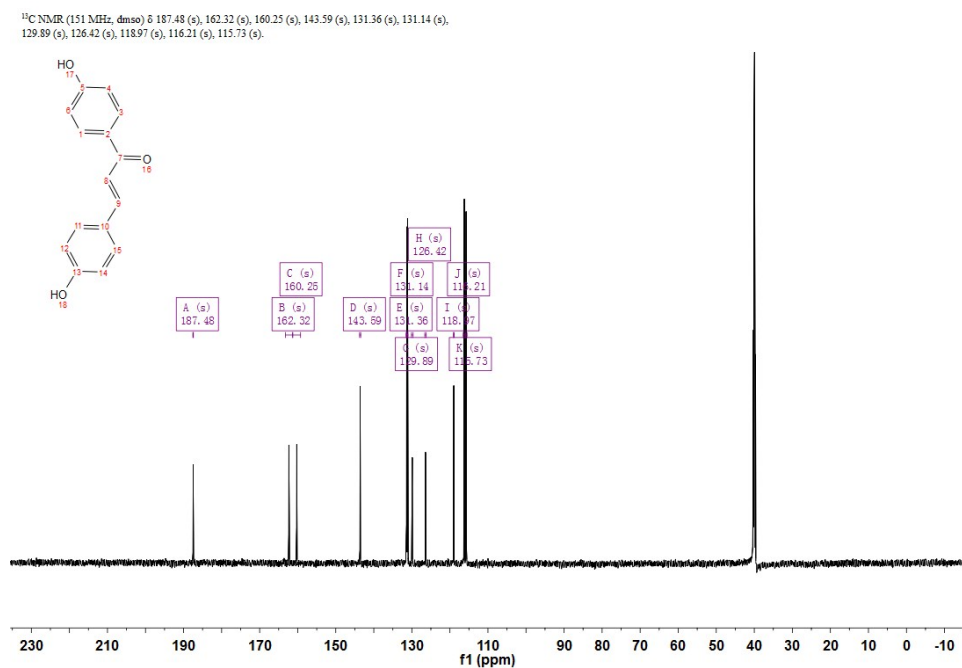


Figure S1b. ¹³C NMR spectrum of BHPP

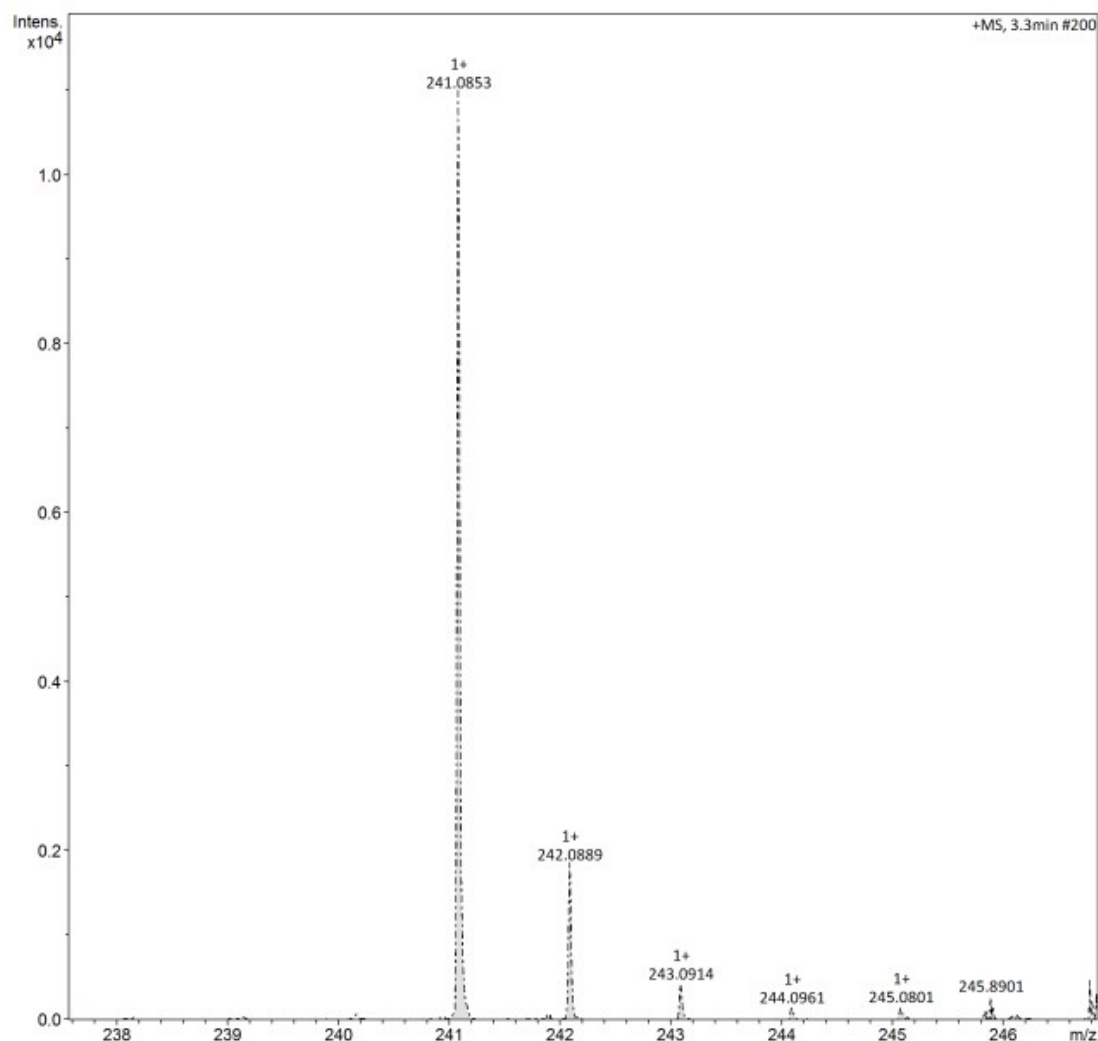


Figure S1c. The Mass spectrum of BHPP

Synthesis of 6-(3,5-bis(4-hydroxyphenyl)-4,5-dihydro-1H-pyrazol-1-yl) -2- butyl -1H-benzo[de]isoquinoline-1,3(2H)-dione(MTPP-NI).

2-butyl-6-hydrazinyl-1H-benzo[de]isoquinoline-1,3(2H)-dione (BHBO) was synthesized according to the previous literature.¹ The BHBO (2.83 g, 10 mmol), BHPP (2.4 g, 10 mmol) and hydrochloric acid (5 mL) were dissolved in anhydrous ethanol (100 mL) and the resulting mixture was stirred at 85 °C for 24 hrs. Then the mixture was cooled to room temperature and filtered. The resulting pure product was dried in the vacuum oven overnight at 60 °C to give a red powder (4.05 g, yield: 80%). mp: > 250 °C. ¹H NMR (400 MHz, DMSO-*d*₆) δ (ppm) 10.00 (s, 1H), 9.74 (d, *J* = 8.5 Hz, 1H), 9.41 (s, 1H), 8.47 (d, *J* = 7.0 Hz, 1H), 8.14 (d, *J* = 8.5 Hz, 1H), 7.86–7.63 (m, 3H),

7.15 (d, $J = 8.1$ Hz, 2H), 6.90 (t, $J = 9.3$ Hz, 3H), 6.67 (d, $J = 8.2$ Hz, 2H), 5.83 (s, 1H), 4.04–3.81 (m, 3H), 3.18 (d, $J = 17.5$ Hz, 1H), 1.57 (s, 2H), 1.31 (d, $J = 7.0$ Hz, 2H), 0.90 (t, $J = 7.1$ Hz, 3H). ^{13}C NMR (151 MHz, $\text{DMSO-}d_6$) δ (ppm) 164.03, 163.08, 159.78, 157.30, 153.89, 145.79, 134.86, 132.33, 131.43, 131.11, 130.49, 128.69, 127.59, 124.89, 122.78, 122.67, 122.02, 116.17, 116.14, 111.86, 110.63, 64.80, 42.53, 30.15, 20.25, 14.15.

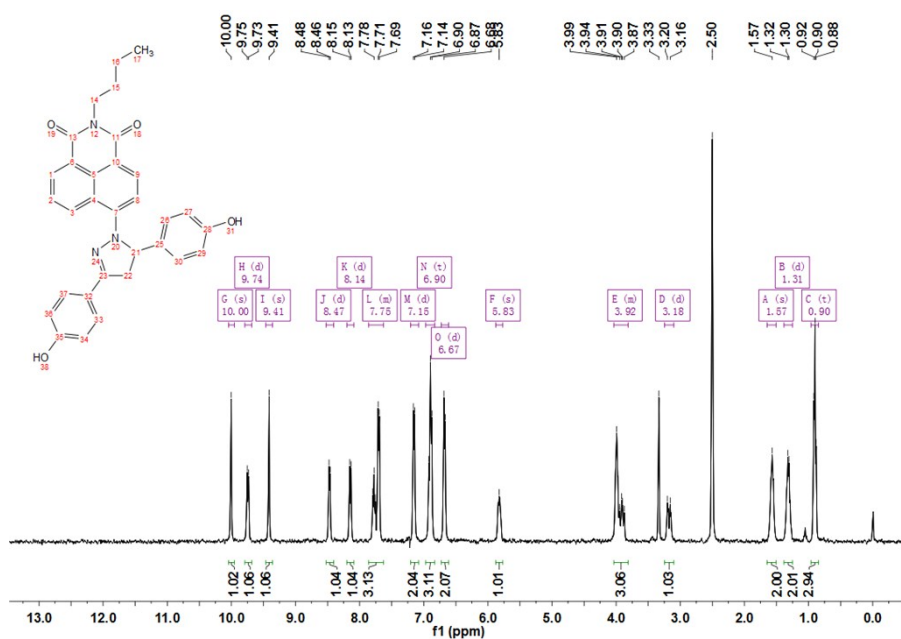


Figure S1d. ^1H NMR spectrum of MTPP-NI.

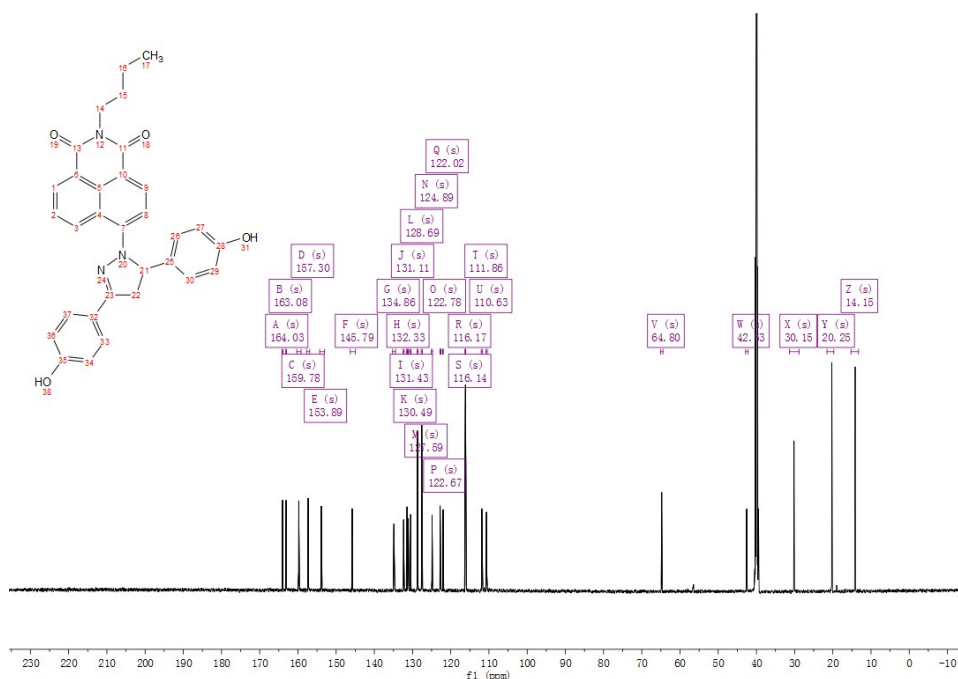


Figure S1e. ^{13}C NMR spectrum of MTPP-NI

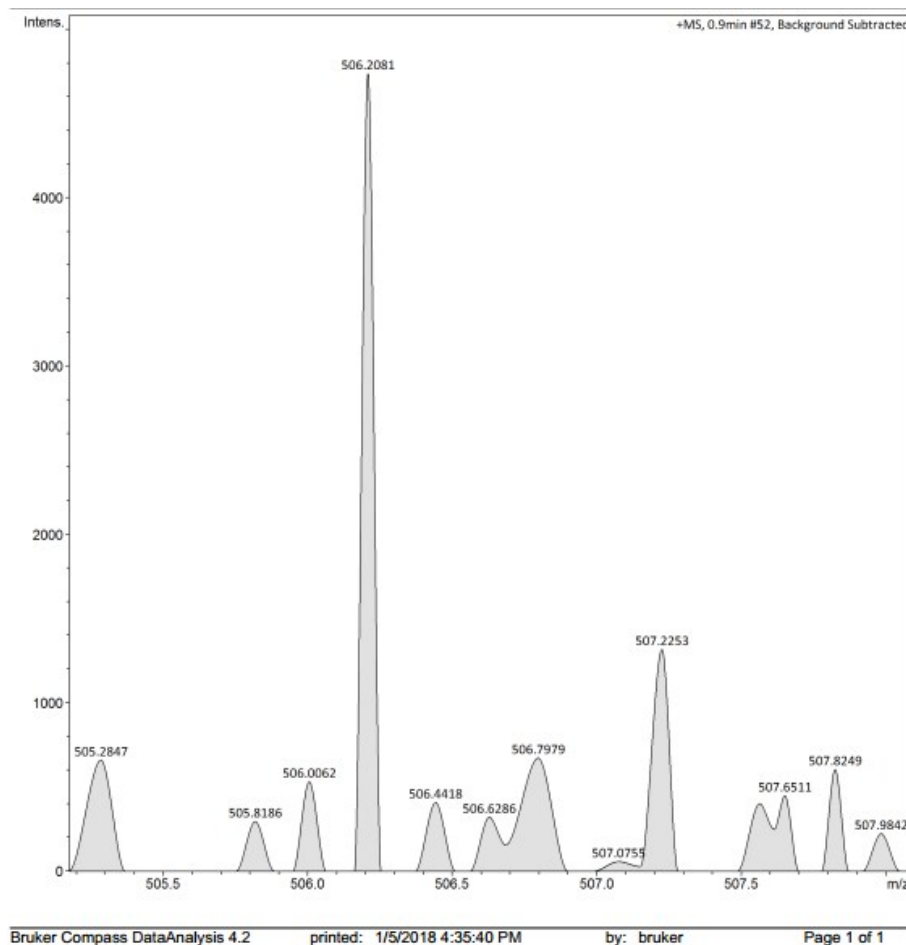


Figure S1f. The Mass spectrum of **MTPP-NI**

Synthesis of 6-(3,5-bis(4-((tert-butyldimethylsilyl)oxy)phenyl)-4,5-dihydro- 1H-pyrazol-1-yl)-2-butyl-1H-benzo[de]isoquinoline-1,3(2H)-dione (MTPP- NITBS).

MTPP-NI (1.012 g, 2 mmol) and imidazole (0.354 g, 5.2 mmol) were dissolved in dichloromethane (40 mL). And then the solution of tert-butyldimethylsilyl chloride (0.97 g, 4.8 mmol) in the dichloromethane (4 mL) was dropwise added into the reaction mixture. The reaction mixture was allowed to stir at room temperature for 24 hrs. After the reaction was completed, the mixture was extracted with ethyl acetate and washed successively with sodium bicarbonate solution and water. The solution was removed by rotary evaporation in vacuum. And the product was purified by silica-gel column chromatography to give a pale yellow powder with a yield of 1.1 g (75%). mp: 168-170 °C. ¹H NMR (400 MHz, CDCl₃) δ (ppm) 9.65 (d, J = 8.6 Hz, 1H), 8.59 (d, J = 7.2 Hz, 1H), 8.25 (d, J = 8.4 Hz, 1H), 7.66 (t, J = 8.6 Hz, 3H), 7.15 (d, J = 8.2 Hz, 2H), 6.89 (d, J = 8.4 Hz, 2H), 6.73 (d, J = 8.1 Hz, 3H), 5.56 (dd, J = 11.0, 7.6 Hz, 1H), 4.19–4.05 (m, 2H), 3.80 (dd, J = 17.0, 11.4 Hz, 1H), 3.20 (dd, J = 17.0, 7.3 Hz, 1H), 1.72–1.61 (m,

2H), 1.40 (dd, $J = 15.0, 7.4$ Hz, 2H), 1.03 – 0.86 (m, 21H), 0.22 (s, 6H), 0.12 (s, 6H).
 ^{13}C NMR (151 MHz, CDCl_3) δ (ppm) 164.76, 163.95, 157.48, 155.44, 151.89, 145.93, 134.40, 132.81, 132.34, 131.18, 130.68, 127.74, 126.98, 124.93, 124.42, 123.27, 122.37, 120.69, 120.51, 120.42, 120.25, 113.47, 110.51, 65.58, 42.59, 39.97, 30.24, 25.68, 25.63, 25.56, 25.53, 20.40, 18.26, 18.11, 13.85, -4.37, -4.46.

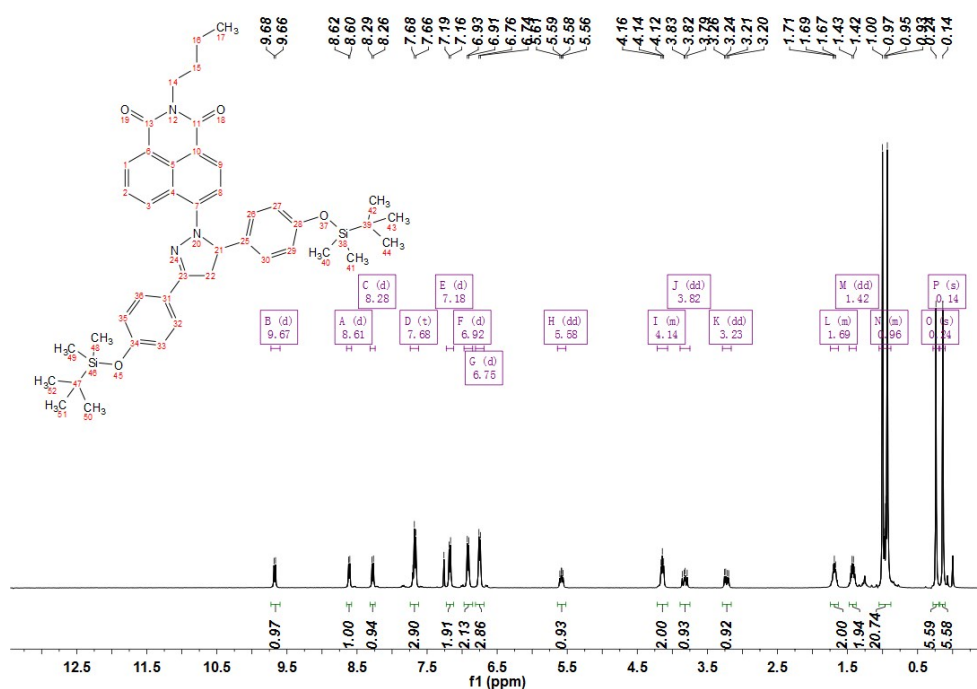


Figure S1g. ^1H NMR spectrum of MTPP-NITBS

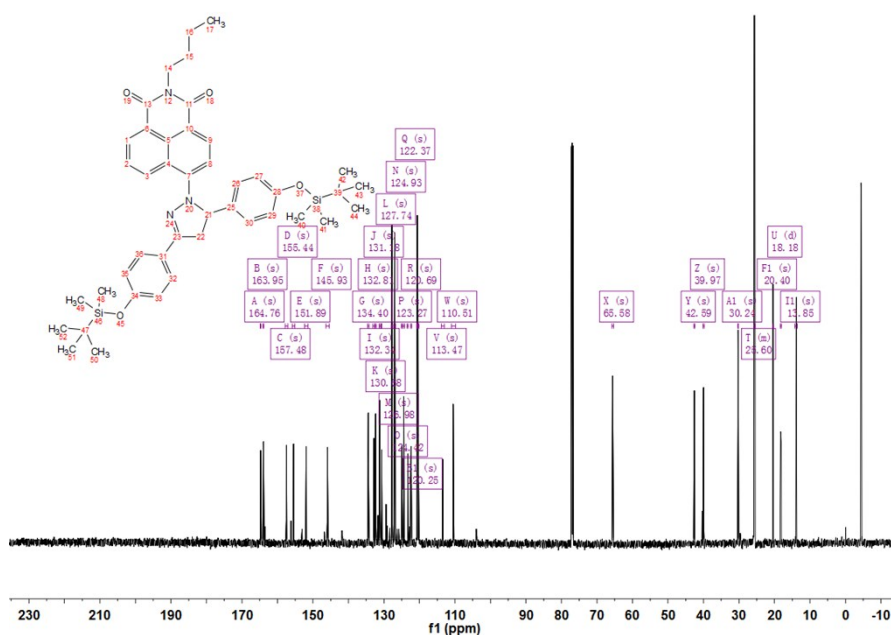


Figure S1h. ^{13}C NMR spectrum of MTPP-NITBS

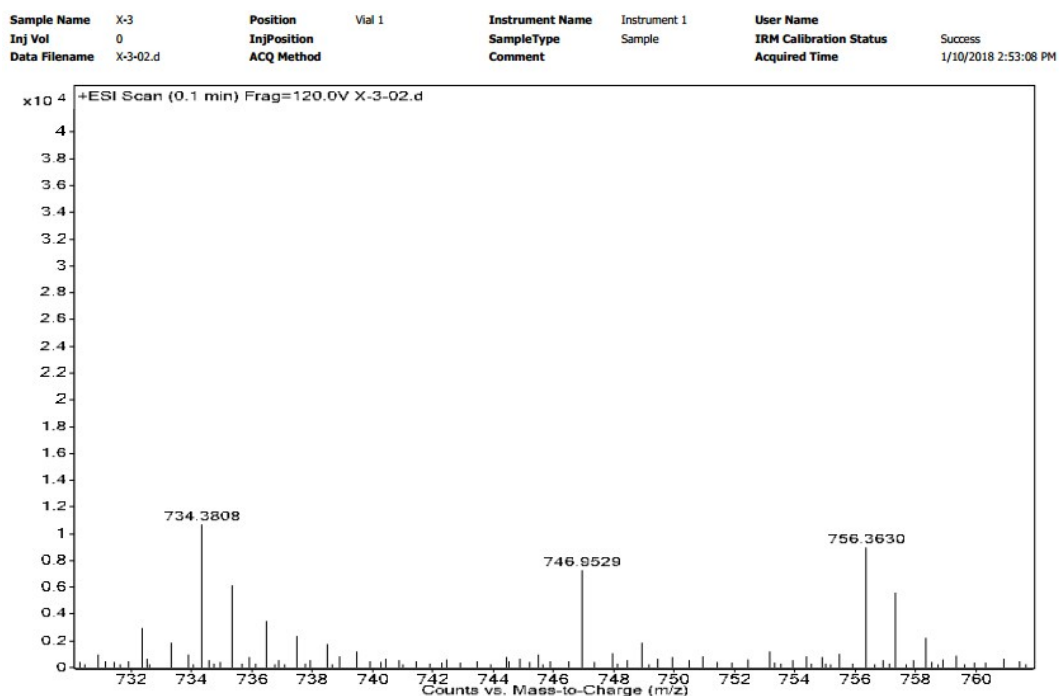


Figure S1i. The Mass spectrum of **MTPP-NITBS**

Synthesis of (1-(2-butyl-1,3-dioxo-2,3-dihydro-1H-benzo[de]isoquinolin-6-yl)-4,5-dihydro-1H-pyrazole-3,5-diyl)bis(4,1-phenylene) bis(sulfurofluoridate) (MTPP-NISO₂F).

The MTPP-NISO₂F was synthesized following a similar method according to the literature.⁴ MTPP-NI (1.012 g, 2 mmol) and triethylamine (0.53 g, 5.2 mmol, 0.73 mL) were dissolved in dichloromethane (20 mL) in a dry 2 L three-necked flask. Then reaction flask was sealed with a rubber stopper, drained of air, and an air bag filled with SO₂F₂ gas was introduced. And the reaction mixture was allowed to vigorously stir under SO₂F₂ atmosphere for 12 hrs at room temperature. After the reaction was completed, the volatiles were removed by rotary evaporation, and the mixture was extracted with ethyl acetate and washed successively with diluted hydrochloric solution, sodium bicarbonate solution and water. The solution was removed by rotary evaporation in vacuum. And the product was purified by silica-gel column chromatography to give a light yellow powder with a yield of 1.07 g (80%). mp: 113-115 °C. ¹H NMR (400 MHz, DMSO-*d*₆) δ (ppm) 9.56 (d, *J* = 8.4 Hz, 1H), 8.47 (d, *J* = 6.7 Hz, 1H), 8.18 (d, *J* = 7.9 Hz, 1H), 8.01 (d, *J* = 7.8 Hz, 2H), 7.81 (t, *J* = 7.6 Hz, 1H), 7.73 (d, *J* = 7.7 Hz, 2H), 7.64 (d, *J* = 7.5 Hz, 2H), 7.56 (d, *J* = 7.7 Hz, 2H), 7.02 (d, *J* = 8.1 Hz, 1H), 6.14 (t, *J* = 9.2 Hz, 1H), 4.03 (dd, *J* = 30.8, 18.4 Hz, 3H), 3.40 (dd, *J* = 18.1, 7.1 Hz, 1H), 1.66 – 1.45 (m, 2H), 1.30 (dd, *J* = 13.5, 6.5 Hz, 2H), 0.88 (t, *J* = 6.6 Hz, 3H). ¹³C NMR (151 MHz, DMSO-*d*₆) δ (ppm) 163.92, 163.08, 151.62, 150.49, 149.36,

145.17, 142.14, 134.13, 132.69, 132.16, 131.29, 130.18, 129.24, 129.10, 125.75, 123.25, 122.31, 122.20, 122.16, 122.04, 114.08, 111.65, 64.64, 42.05, 30.09, 20.21, 14.11.

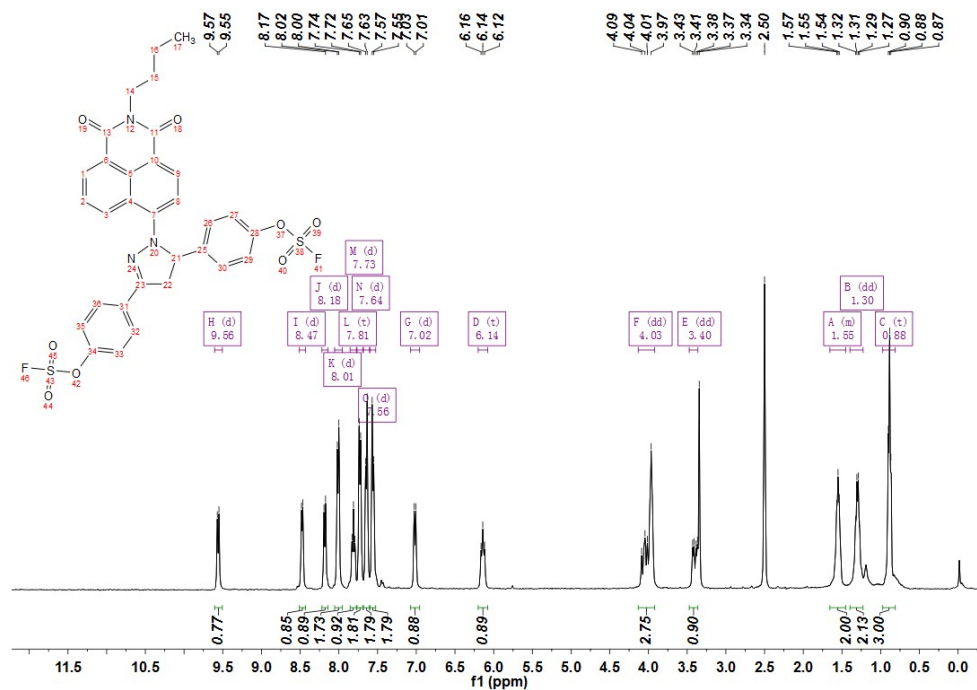


Figure S1j. ^1H NMR spectrum of MTPP-NISO₂F

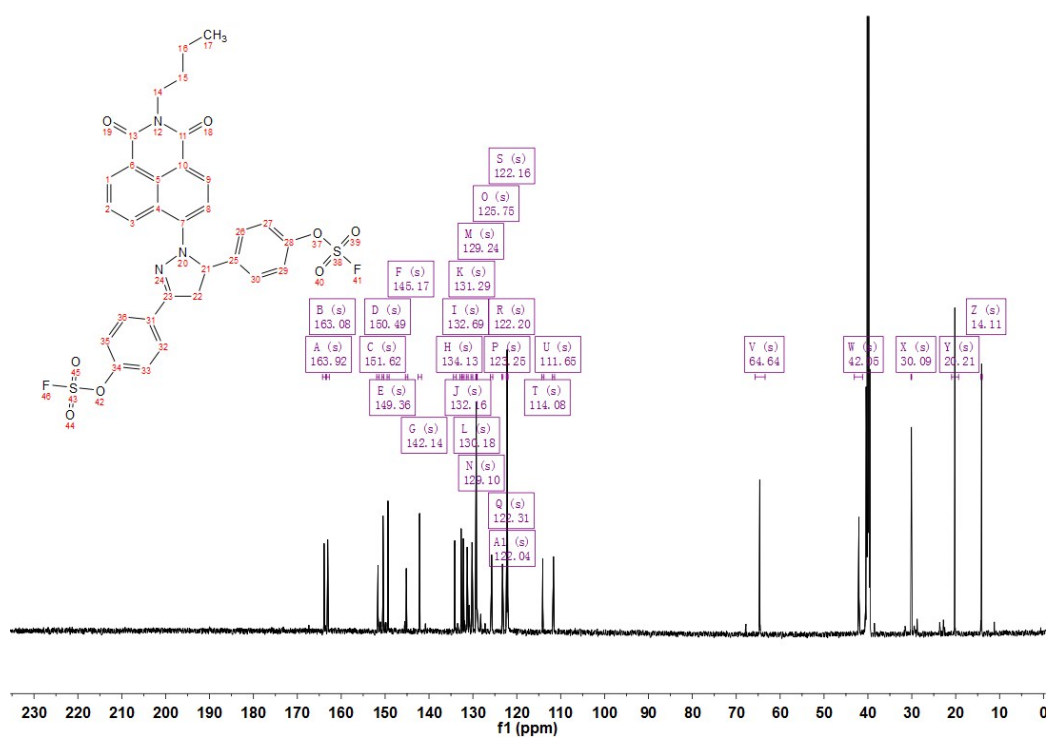


Figure S1k. ^{13}C NMR spectrum of MTPP-NISO₂F

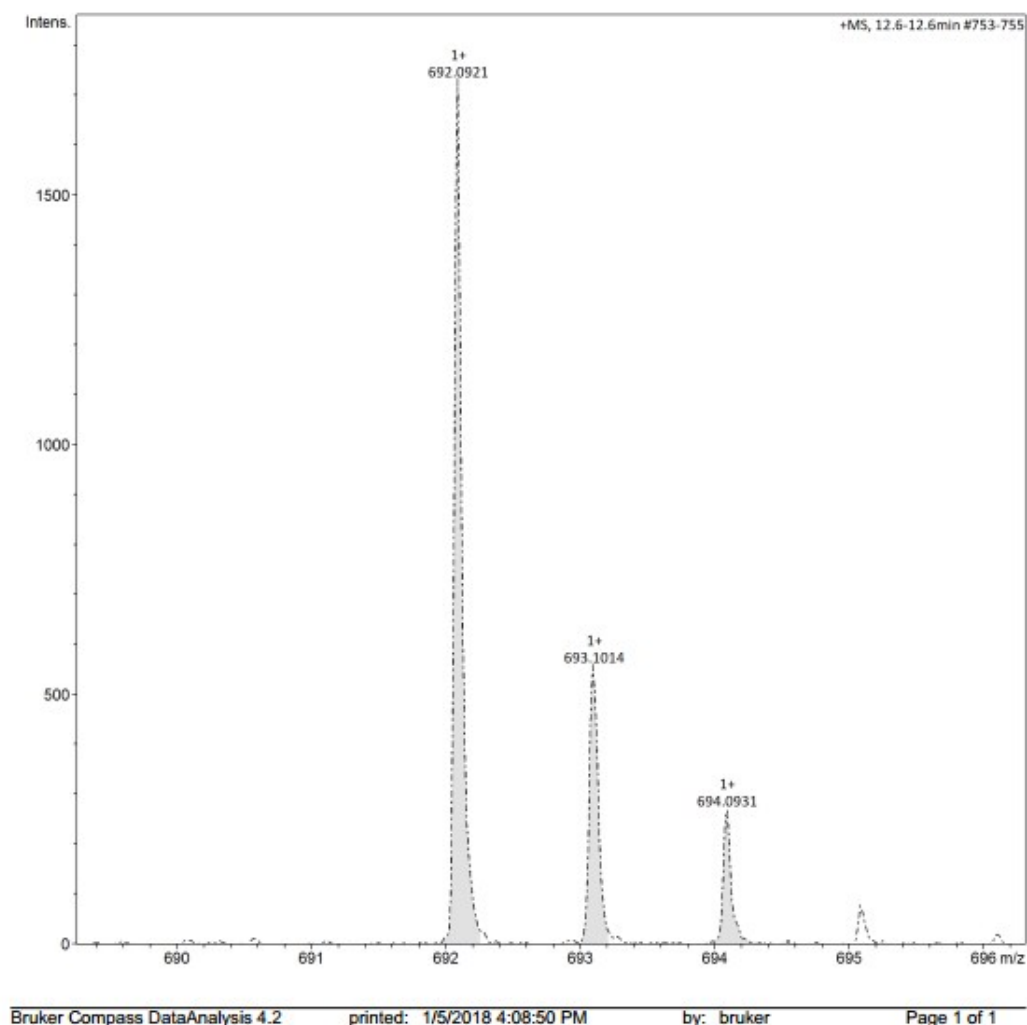


Figure S11. The Mass spectrum of **MTPP-NISO₂F**

Synthesis of 4, 4'-Dihydroxydiphenylsulfone bissilylether (NSOTBS)

Bisphenol S (2.50 g, 10 mmol) and imidazole (1.8 g, 26 mmol) were added in a three neck round bottom flask with 20 mL dichloromethane as the solvent and stirred for 10 min. Then, a solution of the tert-Butyldimethylsilyl chloride (3.6 g, 24 mmol) in dichloromethane (10 mL) was dropped slowly for 30 mins. This reaction was allowed to stir for 24 hrs. After completed, the solvent was removed in vacuum and the residue was completely dissolved in ethyl acetate. The solution was washed by saturated sodium bicarbonate solution and saturated salt water in sequence. The organic solvent was evaporated using a rotary evaporator. The desired product was purified by column chromatography on silica gel. The target intermediate is a white solid with a yield of 87 %. mp: 129-131°C.

^1H NMR (400 MHz, DMSO) δ = 7.81 (d, J =8.4, 4H), 7.03 (d, J =8.4, 4H), 0.93 (s, 18H), 0.21 (s, 12H). ^{13}C NMR (75 MHz, DMSO) δ = 159.80 (s, 1H), 134.62 (s, 1H), 129.95 (s, 4H), 121.07 (s, 4H), 25.82 (s, 8H), 18.35 (s, 2H), -4.23 (s, 3H).

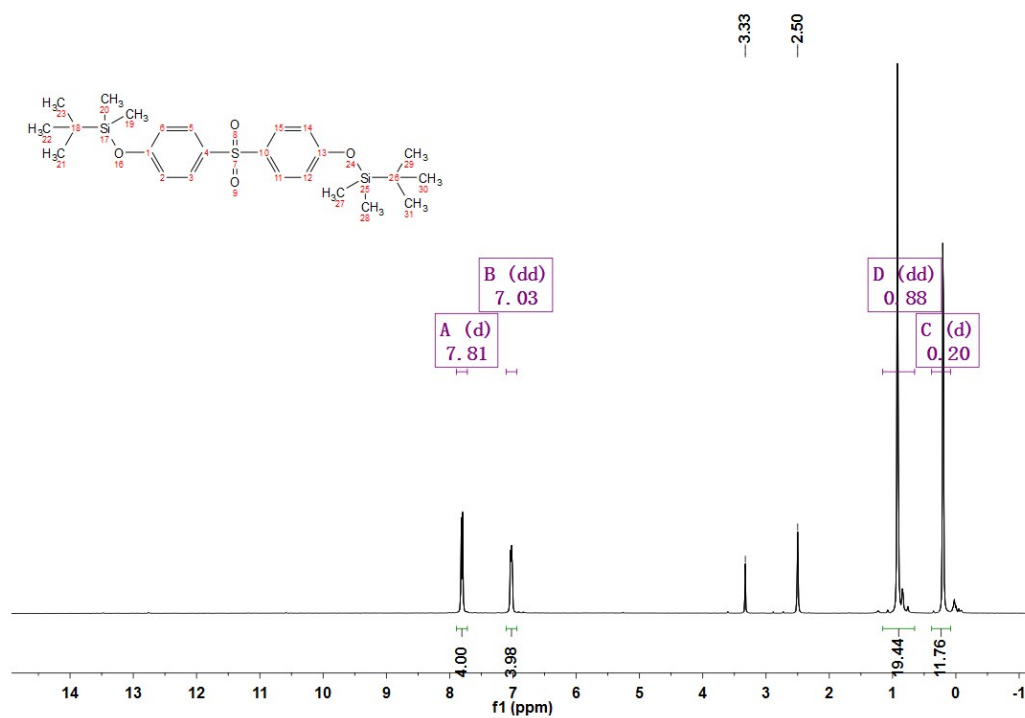


Figure S1m. ^1H NMR spectrum of NSOTBS

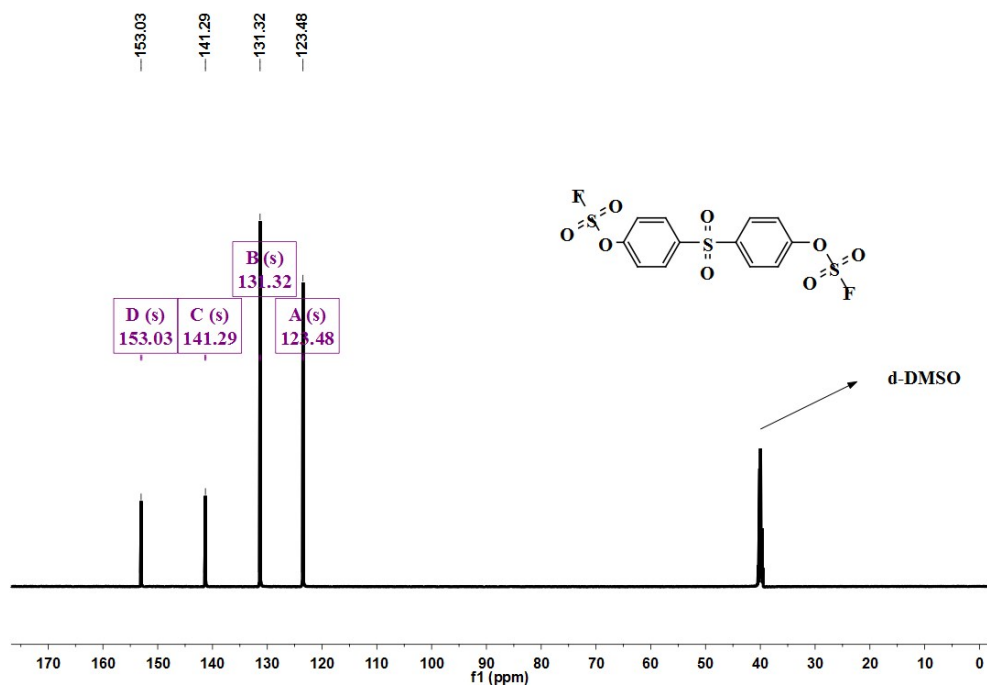


Figure S1n. ^{13}C NMR spectrum of NSOTBS

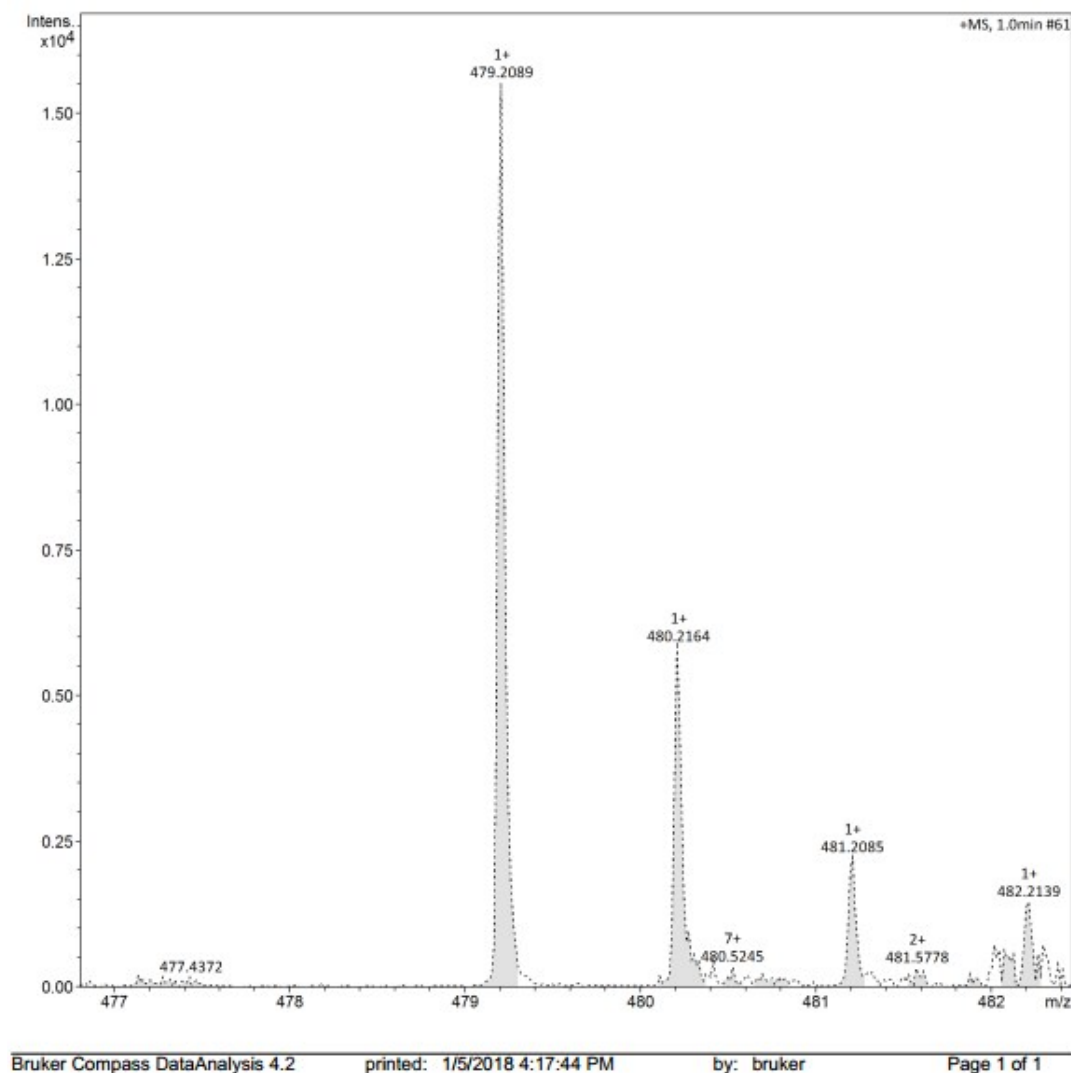


Figure S1o. The Mass spectrum of NSOTBS

Synthesis of PolyTPP-NI and CPTPP-NI via the SuFEx Click Reaction.

Synthesis of PolyTPP-NI.

MTPP-NITBS (367 mg, 0.5 mmol) and MTPP-NISO₂F (335 mg, 0.5 mmol) were dissolved in N,N-dimethylformamide (2 mL). Then the catalyst DBU (15.2 mg, 0.1 mmol) was added dropwise into the reaction mixture and stirred for 24 hrs at room temperature. The mixture was poured into methanol and the precipitate was filtered. A orange powder was obtained and dried under vacuum with a yield of 520 mg (89.2%).

Synthesis of CPTPP-NI.

NSOTBS (340 mg, 0.5 mmol) and MTPP-NISO₂F (335 mg, 0.5 mmol) were dissolved in N,N-dimethylformamide (2 mL). DBU (15.2 mg, 0.1 mmol) was dropwise

added into the reaction mixture, and the resulting mixture was stirred for 24 hrs at room temperature. The mixture was poured into methanol and the precipitate was filtered. A orange powder was obtained and dried under vacuum with a yield of 396 mg (90.0%).

Characterization:

^1H NMR spectra were measured by Agilent 400 or 600 MHz NMR spectrometers with CDCl_3 , $\text{DMSO-}d_6$ or $\text{DMF-}d_7$ as the solvent and tetra-methylsilane (TMS) as the internal standard at ambient temperature. The molecular weights and polydispersity index (PDI), relative to PS ($M_n = 25000$) were measured using Waters1515 GPC with

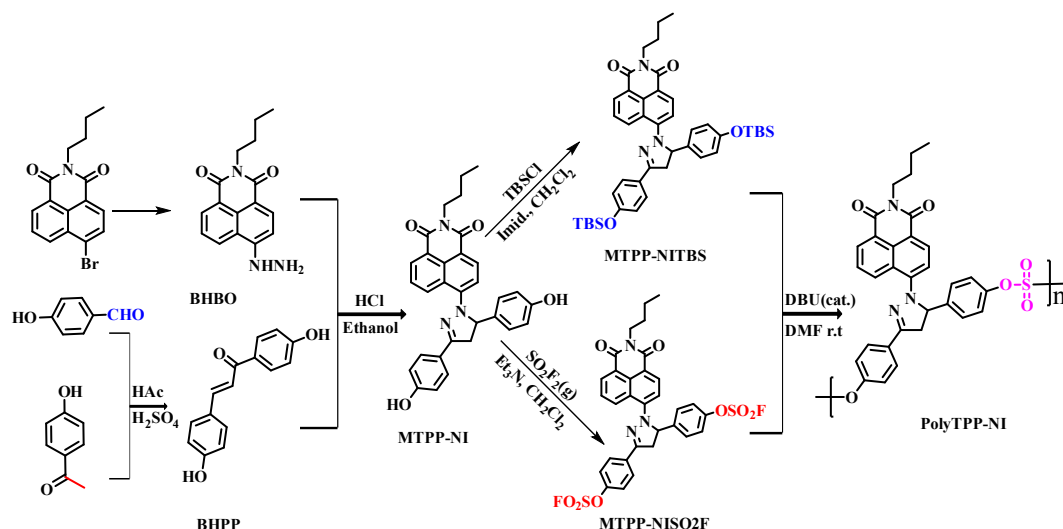
DMF as a mobile phase at a rate of $1\text{ mL}\cdot\text{min}^{-1}$ and with column temperature of $30\text{ }^\circ\text{C}$.

UV-visible absorption spectra were determined using a Shimadzu RF540 spectrophotometer. Room temperature emission spectra were recorded using an Edinburgh-920 Fluorescence spectrophotometer. HPLC-ION TRAP MS was performed on an amazon SL ion trap mass spectrometer (Bruker Daltonics, Bremen, Germany) and LC-MS was performed on an Agilent 1200/6220 eluting with CH_3OH . All electrical measurements of the device were characterized under ambient conditions, without any encapsulation, using a Keithley 4200-SCS semiconductor parameter analyzer. Cyclic voltammetry (CyV) measurements were carried out in 0.1 M acetonitrile solution of tetra-n-butylammonium hexafluoro-phosphate (TBAPF_6) with a CHI-660C electrochemical workstation containing a platinum gauze auxiliary electrode and an Ag/AgCl reference electrode. The DFT and MD simulations of MTPP-NI, PolyTPP-NI were implemented using the Materials Studio software package. For the electronic properties of the repeat unit, the BLYP functional with Grimme correction was chosen to optimize the geometrical structure in the vacuum by the Dmol3 module. All the electron core treatments and DNP 4.4 basis were set during the whole calculation. The convergence standard of $2.0 \times 10^{-5}\text{ Ha}$ energy and $0.004\text{ Ha}/\text{\AA}$ maximum force was enough to ensure the accuracy of calculations.

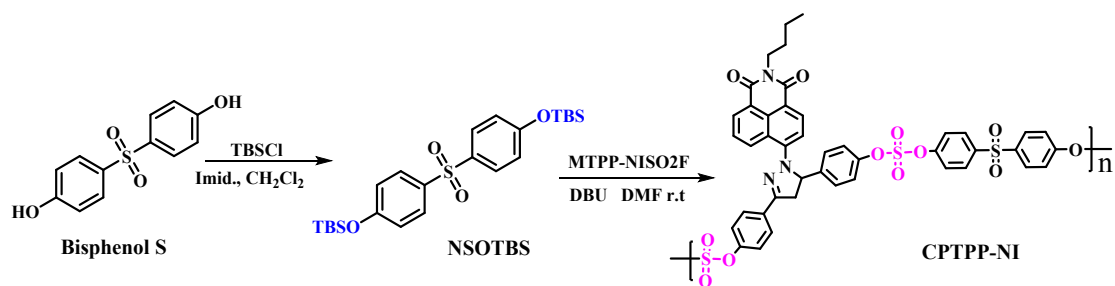
Fabrication of memory devices:

Firstly, indium tin oxide (ITO) glass was cleaned by using a sequence of deionized water, acetone and anhydrous ethanol for 20 minutes after each other. The MTPP-NI thin films were evaporated under vacuum using a vacuum deposition apparatus to take 35 mg of MTPP-NI on the furnace with the degree of vacuum set to $3 \times 10^{-4}\text{ Pa}$. MTPP-NI in the evaporator furnace was slowly sublimated to the ITO glass surface. A cyclopentanone solution of PolyTPP-NI ($10\text{ mg}\cdot\text{mL}^{-1}$) was spin-coated onto the ITO-glass substrate using a spin coater at a rotational speed of 2000 rpm for 30 seconds. The organic molecule films were annealed in a vacuum chamber at 10^{-5} torr and $80\text{ }^\circ\text{C}$ for

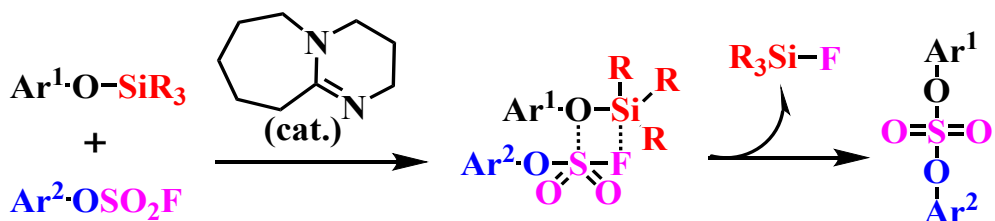
10 hrs. The CPTPP-NI thin films were prepared using the same process as PolyTPP-NI.



Scheme S1. The synthesis and chemical structures of **MTPP-NI** and **PolyTPP-NI**. TBSCl=tert-Butyldimethylsilyl chloride, Imid=Imidazole, DMF=N,N-Dimethylformamide, DBU=1,8-Diazabicyclo[5.4.0]undec-7-ene.



Scheme S2. The synthesis and chemical structures of **CPTPP-NI**.



Scheme S3. The mechanism of SuFEx reactivity². Solvent: polar aprotic (CH₃CN, DMF, NMP); Catalyst: DBU (10-30 mol %); SiR₃ = SiMe₃ (< 4 h, RT); SiR₃ = SiMe₂tBu (4-18 h, RT to 80°C).

Table S1 Comparison of polymerization conditions ^[a]

Solvent	Temperature	Mn	Dispersity	Yield
NMP	20 °C	17900	1.6	80%
THF	20 °C	13300	1.2	80%
DMF	20 °C	30700	1.3	86%
DMF	40 °C	14900	1.4	84%
DMF	60 °C	14800	1.4	86%

[a] Unchanged polymerization conditions: 20%DBU, 24 h.

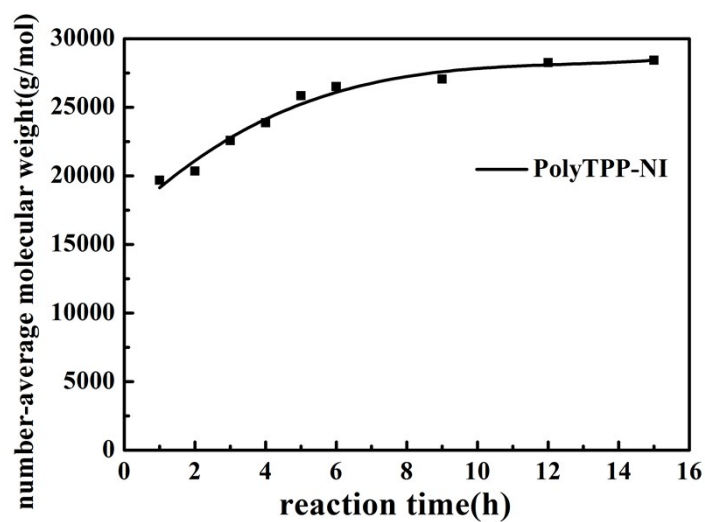


Fig. S2. The change curve of polymer molecular weight over time in DMF at 20 °C

Thermal stabilities

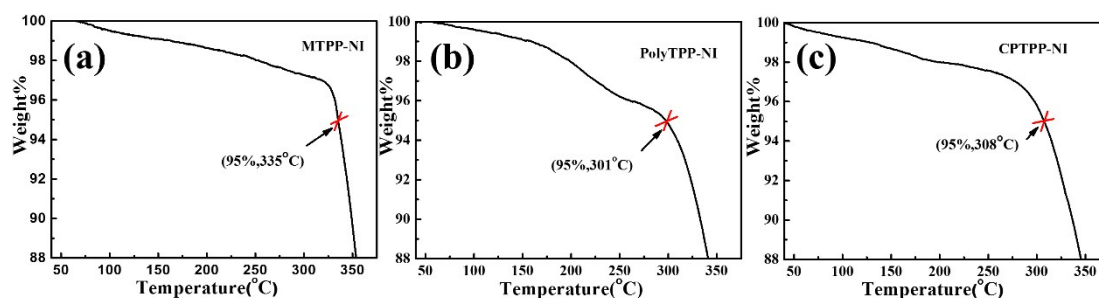


Fig. S3. (a) The thermal stabilities of **MTPP-NI**. (b) The thermal stabilities of **PolyTPP-NI**. (c) The thermal stabilities of **CPTPP-NI**.

Electrochemical properties

Table S2. Optoelectronic properties and calculated energy levels of all compounds.

compound	UV-vis, λ (nm)			E_g (eV) ^c	E_{ox} (onset) (eV)	HOMO(eV) ^d	LUMO(eV)
	λ_{max} ^a	λ_{max} ^b	λ_{onset} ^b				
MTPP-NI	469	500	584	2.12	0.71	-5.08	-2.96
PolyTPP-NI	451	451	533	2.33	0.72	-5.09	-2.76
CPTPP-NI	460	465	529	2.34	0.69	-5.06	-2.72

a In THF dilute solution. b In thin films. c The data was calculated by the following equation: $bandgap = 1240/\lambda_{onset}$ of compound films. d The HOMO energy levels were calculated from cyclic voltammetry and were referenced to ferrocene (4.80 eV).

The highest occupied molecular orbital (HOMO) and the lowest unoccupied molecular orbital (LUMO) energy levels can be calculated from the CyV measurement results and the UV visible absorption spectra via the following equations: ³

$$E_{HOMO} = -[E_{ox} (onset) + 4.80 - E_{Foc}]$$

$$E_{LUMO} = E_{HOMO} + E_g$$

where E_{ox} is the onset oxidation potential, E_{Foc} is the external standard potential of the ferrocene/ferrocenium ion couple and E_g represents the band gap determined from UV-visible absorption. The E_{Foc} is 0.43 eV from the CyV measurement with the bare ITO glass substrate without any organic films.

The optical band gaps of the MTPP-NI, PolyTPP-NI and CPTPP-NI films estimated from the absorption edges were 2.12, 2.33 and 2.34 eV, respectively. The onset oxidation (Eox) measured from the CyV curves for the thin films of MTPP-NI, PolyTPP-NI and CPTPP-NI were 0.71 eV, 0.72 eV and 0.69 eV, respectively. The HOMO energy levels of MTPP-NI, PolyTPP-NI and CPTPP-NI were determined to be -5.08 eV, -5.09 eV and -5.06 eV. In addition, the LUMO energy levels of MTPP-NI, PolyTPP-NI and CPTPP-NI were determined to be -2.96 eV, -2.76 eV and -2.72 eV. The opto-electronic properties and calculated energy levels for each of the compounds are summarized in Table S2.

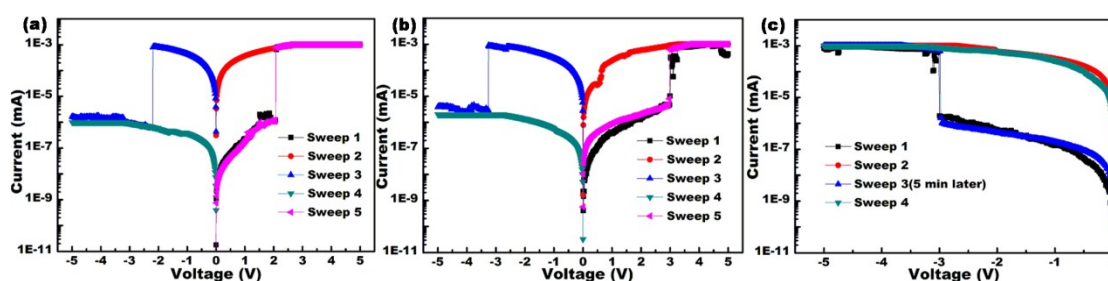


Fig. S4 Typical I–V curves for ITO/active layer/Au memory devices of a) **PolyTPP-NI**, b) **CPTPP-NI**, c) **MTPP-NI** at compliance currents of 0.001 A.

Table S3. HOMO, LUMO and ESP of **PolyTPP-NI**, **CPTPP-NI** and **MTPP-NI**

moleculars	HOMO	LUMO	ESP
PolyTPP-NI			
CPTPP-NI			

MTPP-NI

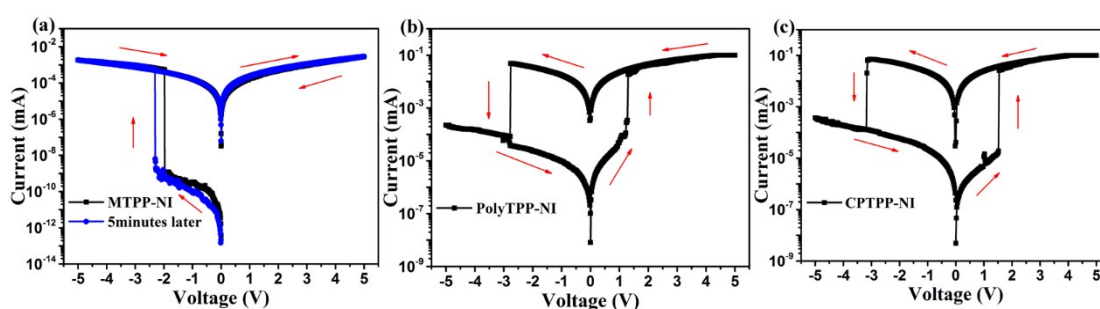
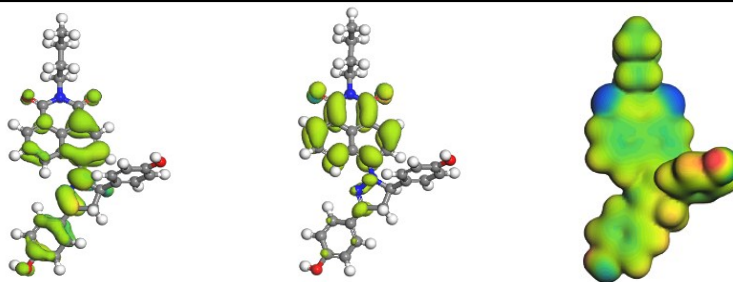


Fig. S5 The IV-characteristics of (a) MTPP-NI, (b) PolyTPP-NI, (c) CPTPP-NI by continuing sweeps across 0 V with arrows indicating the direction of the sweep.

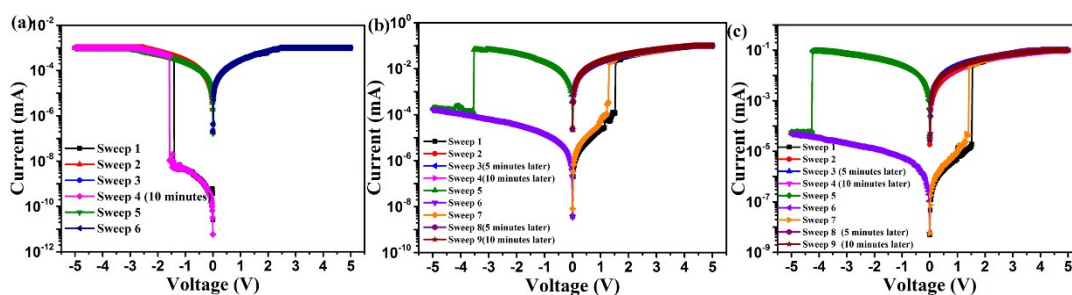
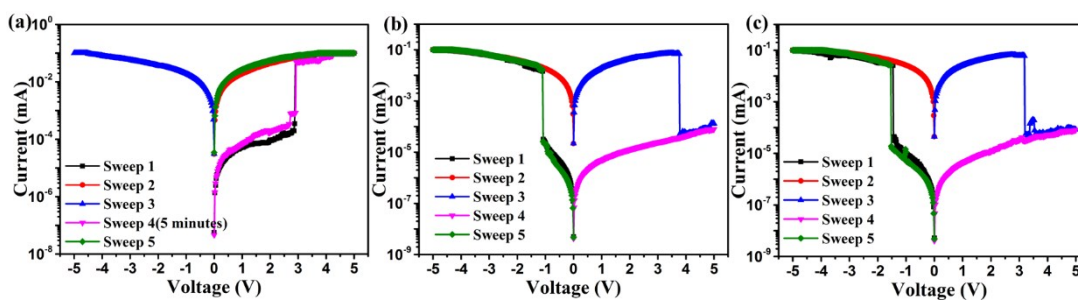


Fig. S6 The IV-characteristics of (a) MTPP-NI, (b) PolyTPP-NI, (c) CPTPP-NI by sweeping with different delay times (5 minutes later and 10 minutes later respectively) after switching off the applied bias.



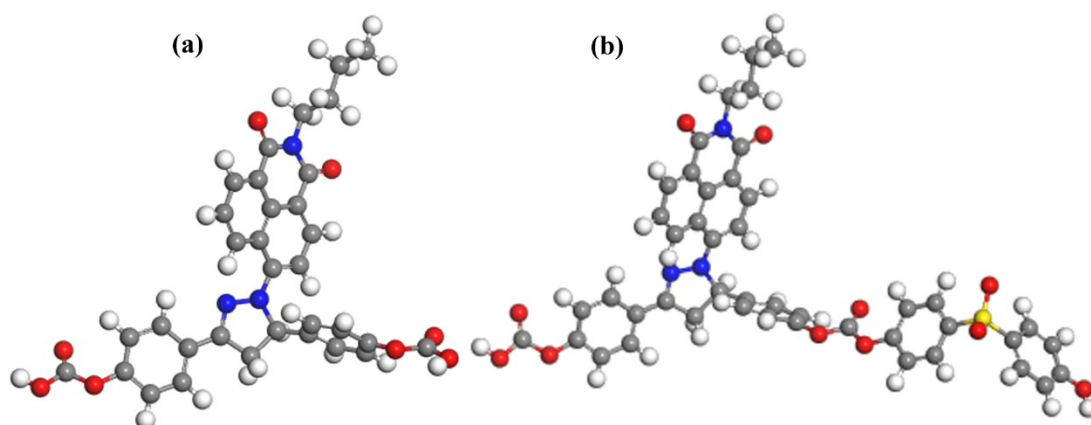
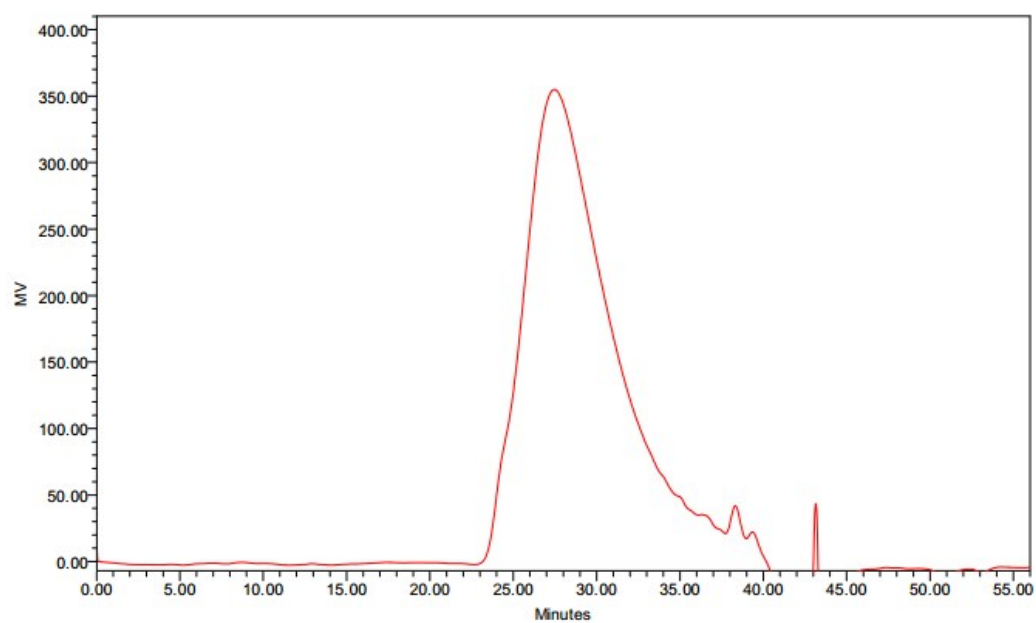


Fig. S7 The IV-characteristics of (a) MTPP-NI by scanning from Scan from positive voltage direction and (b)PolyTPP-NI, (c) CPTPP-NI starting from negative voltage direction

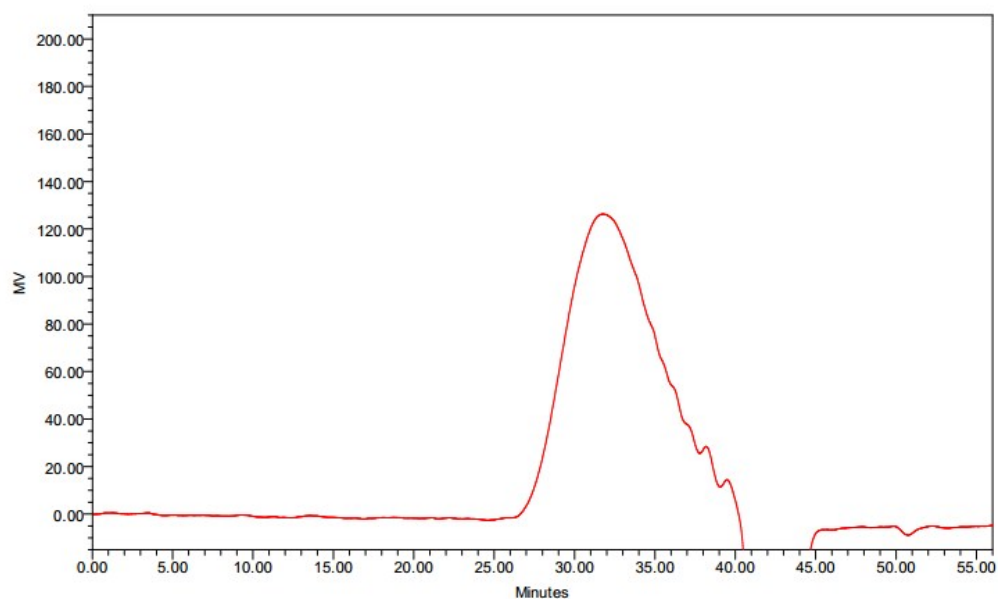
Fig. S8 The simulated molecular structure and corresponding dipole moment of (a) PolyTPP-PC (2.02 D), (b) CPTPP-PC (3.20 D).



GPC Results

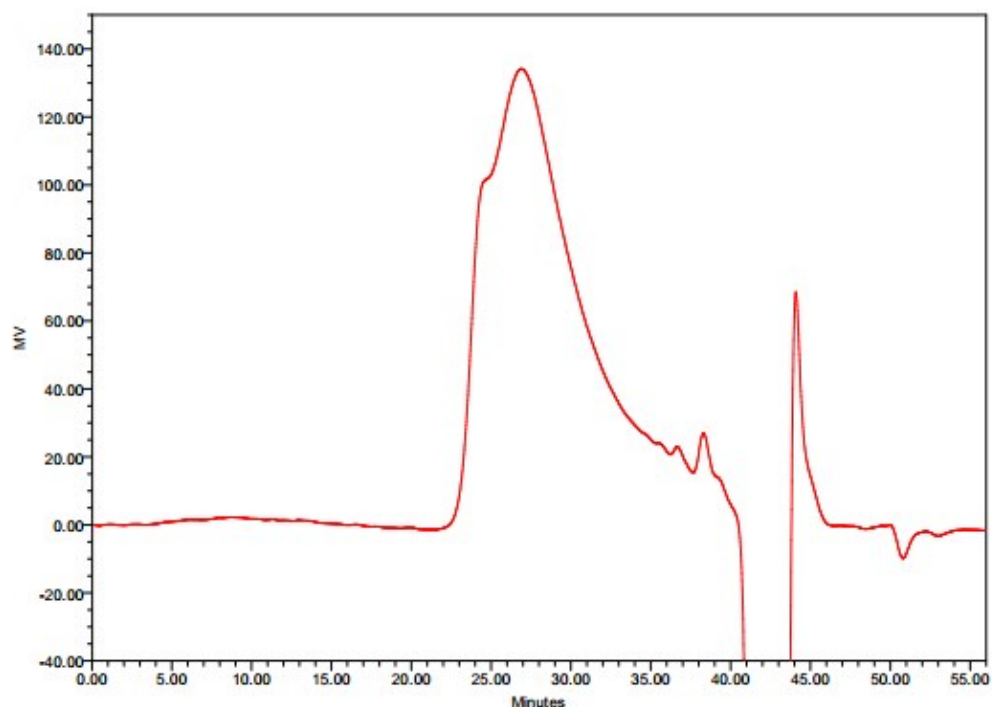
	SampleName	Mn	Mw	MP	Mz	Mz+1	Poly dispersity
1	CHF-1	17929	29324	29876	44541	62753	1.635594

Fig. S9 Accompanying GPC Traces for Table S1. Effect of solvent (NMP) on polymer molecular weight of PolyTPP-NI.



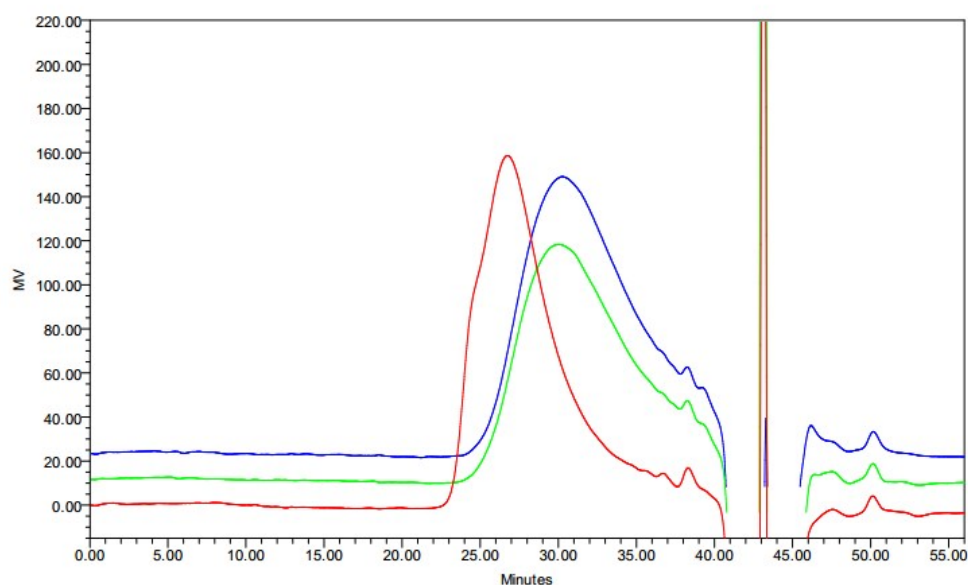
GPC Results						
SampleName	Mn	Mw	MP	Mz	Mz+1	Poly dispersity
1 CHF-THF	13302	16034	16644	18703	21333	1.205396

Fig. S10 Accompanying GPC Traces for Table S1. Effect of solvent (THF) on polymer molecular weight of PolyTPP-NI.



GPC Sample Results							
Sample Name	Inj	RT (min)	Mn	Mw	MP	Mz	Poly-dispersity
1 CHF-DMF	1	26.850	30651	50097	45357	78319	1.634

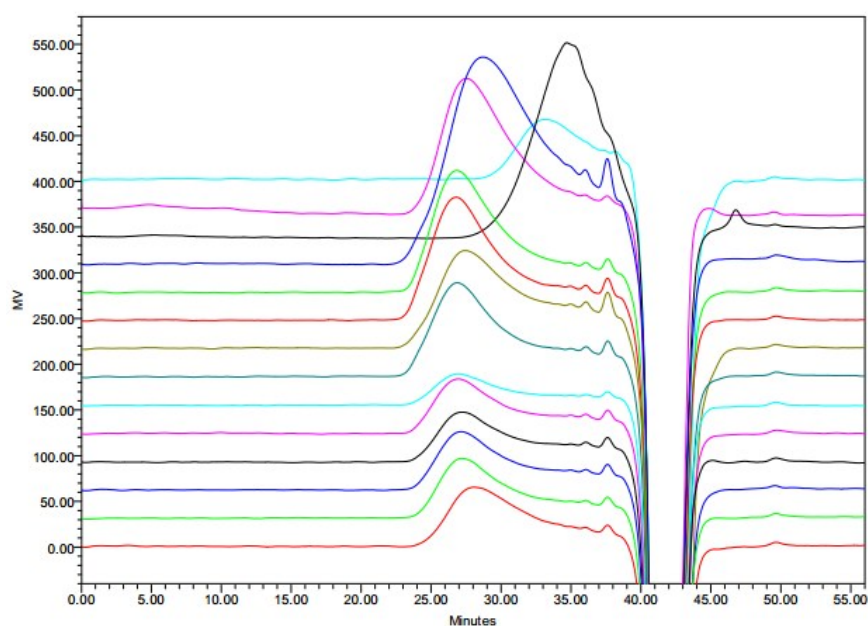
Fig. S11 Accompanying GPC Traces for Table S1. Effect of solvent (DMF) on polymer molecular weight of PolyTPP-NI.



GPC Results

	SampleName	Mn	Mw	MP	Mz	Mz+1	Poly dispersity
1	CHF-1	26461	45630	45689	68293	93541	1.724426
2	CHF-2	14904	21663	22123	29661	39828	1.453543
3	CHF-3	14763	20904	21386	27956	36643	1.415951

Fig. S12 Accompanying GPC Traces for Table S1. The temperature effect on polymer molecular weight of PolyTPP-NI.



GPC Sample Results								
	Sample Name	Inj	RT (min)	Mn	Mw	MP	Mz	Poly-dispersity
1	CHF-1	1	27.933	20351	27252	29851	36225	1.339
2	CHF-2	1	27.133	23578	33047	36914	44277	1.402
3	CHF-3	1	27.081	23865	34160	37471	46421	1.431
4	CHF-4	1	27.117	27051	35813	37090	47018	1.324
5	CHF-5	1	26.865	28504	38625	39898	51510	1.355
6	CHF-6	1	26.957	28247	38171	38836	51016	1.351
7	CHF-9	1	26.817	29421	41175	40481	57548	1.400
8	CHF-12	1	27.317	25835	35652	35072	50602	1.380
9	CHF-15	1	26.717	26505	40299	41722	58666	1.520
10	CHF-26	1	26.767	25927	38134	41094	53818	1.471
11	CHF-36	1	28.500	19678	28080	26090	42762	1.427
12	CHF-44	1	34.567	8852	9574	8633	10349	1.082
13	CHF-YI	1	27.525	23396	31866	33153	43296	1.362
14	CHF-ER	1	32.933	10193	11234	11606	12229	1.102

Fig. S13 Accompanying GPC Traces for Table 1 and Figure S2.Effect of reaction time on polymer molecular weight of PolyTPP-NI.

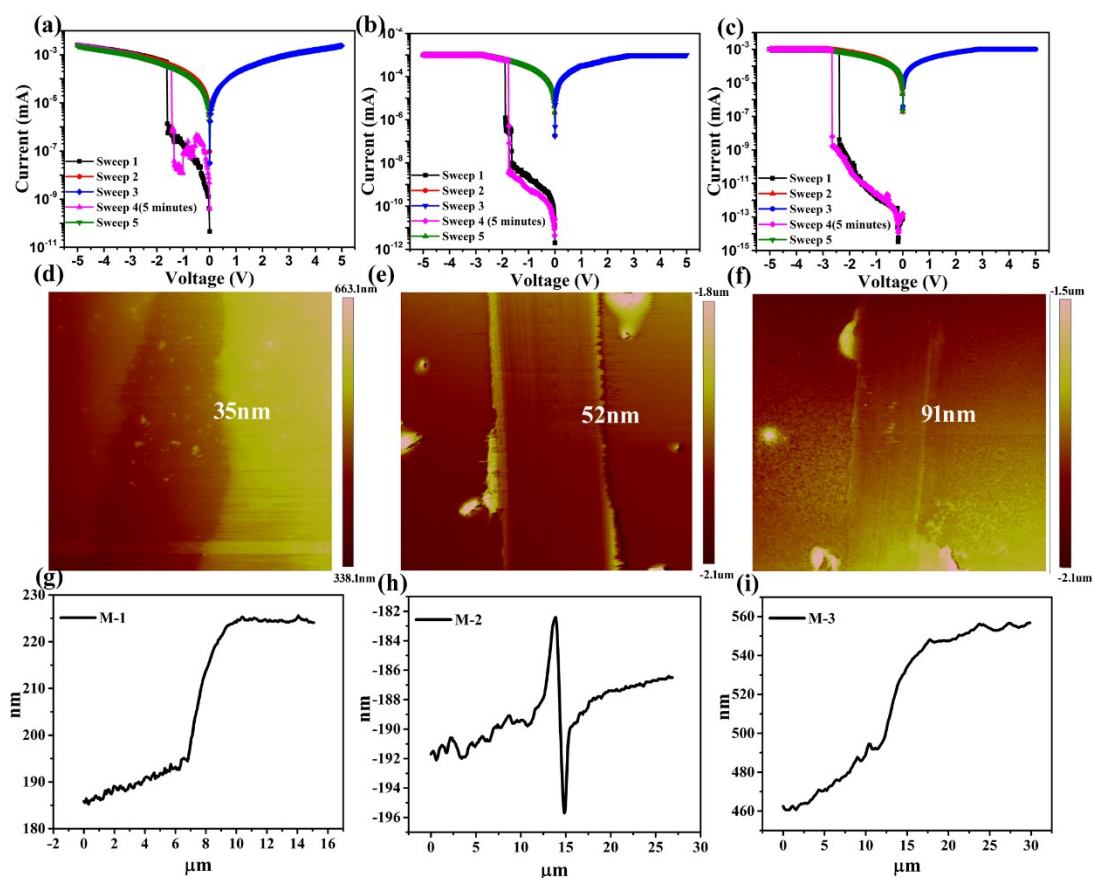


Fig. S14 Typical I-V curves of the MTPP-NI based device with different thickness, (a) M-1(35nm), (b) M-2(52nm), (c) M-3(91nm) and AFM images of the (d,g) M-1(35nm), (e, h) M-2(52nm), (f, i) M-3(91nm).

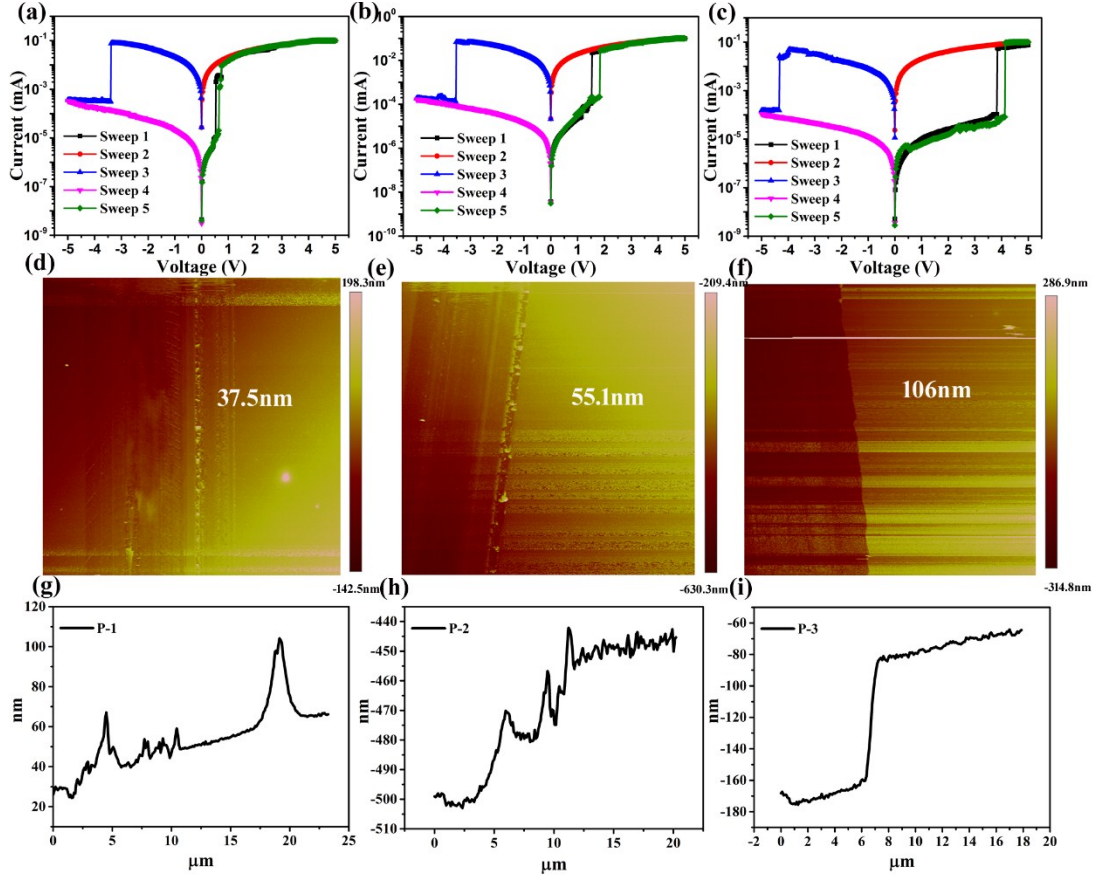


Fig. S15 Typical I-V curves of the PolyTPP-NI based device with different thickness, (a) P-1(37.5nm), (b) P-2(55.1nm), (c) P-3(106nm) and AFM images of the (d,g) P-1(37.5nm), (e, h) P-2(55.1nm), (f, i) P-3(106nm).

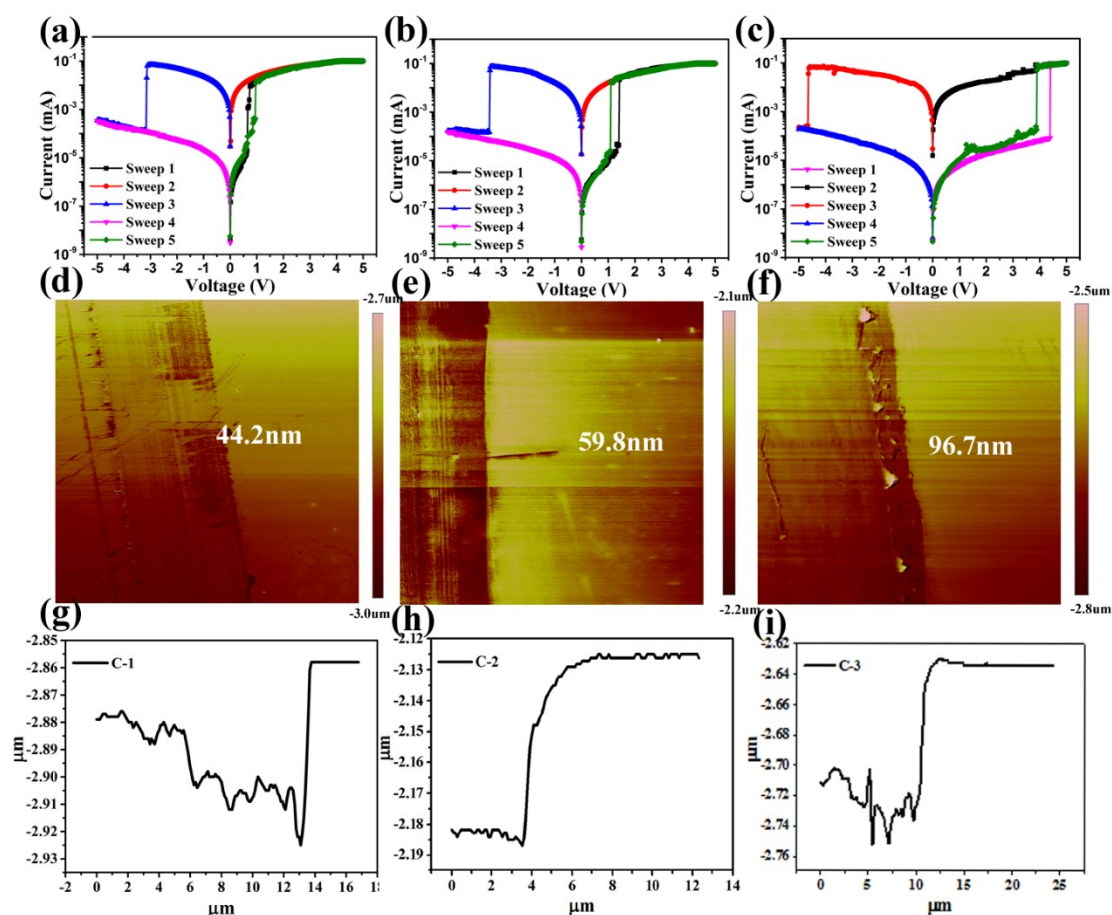


Fig. S16 Typical I-V curves of the CPTPP-NI based device with different thickness, (a) C-1(44.2nm), (b) C-2(59.8 nm), (c) C-3(96.7nm) and AFM images of the (d,g) C-1(44.2nm), (e, h) C-2(59.8 nm), (f, i) C-3(96.7nm).

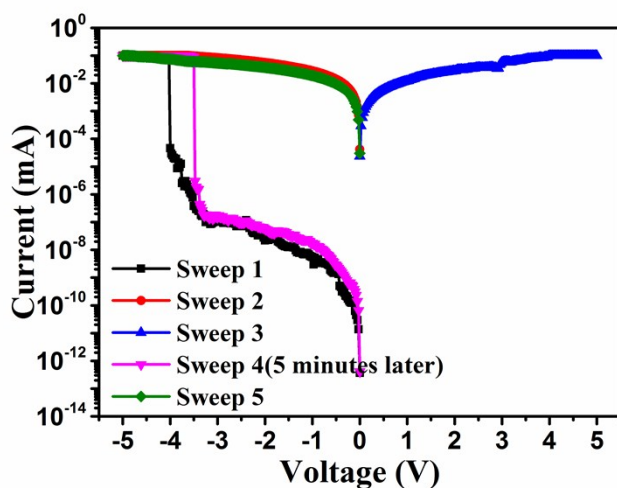


Fig. S17 Typical I-V curves of the ITO/MTPP-NI/Al which prepared in a similar way (spin-coated onto the ITO-glass substrate using a spin coater) as for the polymeric materials. (a cyclopentanone solution of MTPP-NI (10 mg.mL^{-1}) was spin-coated onto

the ITO-glass substrate using a spin coater at a rotational speed of 2000 rpm for 30 seconds).

We have prepared a device with the electro-active layer MTPP-NI in the same way as for the polymeric materials. And the I - V performance showed that the device also exhibits a SRAM electron storage behavior (Fig. S17).

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