Electronic Supplementary Material (ESI) for RSC Advances.

# Supporting Information

## Tuneable luminescence and morphology of amphiphilic platinum(II) complex via the incorporation of cationic surfactant

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## 1. Materials and Instruments.

All reagents were used as received and without further purification, or were prepared according to literature procedure. 1, 12-Dibromododecane (95%) and Potassium tert-butoxide (98%) were purchased from J&K, 2-ethoxyethanol and (2, 4-difluorophenyl)boronic acid (98%) were purchased from TCI. The ultrapure water was purified by Aquapro ALH-6000-U.

**$^1$H NMR Experiments**

$^1$H NMR spectra were recorded on a 400 MHz Bruker spectrometer in $CDCl_3$ solutions, by using $Me_4Si$ as internal standard. Chemical shifts were reported in ppm downfield from $Me_4Si$.

**ESI-MS Experiments**

ESI-MS were recorded on a Bruker APEX II Fourier transform ion cyclotron mass spectrometerresonance.

**UV-Vis Absorption Spectra Experiments**

UV-vis absorption spectra were recorded by using an Agilent Technologies Cary 60 spectrophotometer.

**Emission Spectra Experiments**

Luminescence measurements were made on Edinburgh Edinburgh FLS920 with a xenon lamp as the excitation source and optical filter. Quantum yield was obtained with Edinburgh FLS920 spectrograph using excitation wavelength at 385 nm.

**Fluorescence Microscope Experiments**

Fluorescence microscope images were performed with Leica DM4000B. Upon excitation of these mixture systems in aqueous medium at 340-380 nm, fluorescence microscope photos were taken. The samples in aqueous medium were prepared by taking a drop of mixture solution on a glass slide and covered with a cover slip, and the fluorescence microscope photos were collected quickly. The samples at dry state were prepared by taking a drop of mixture solution on a glass slide and dried at room temperature.

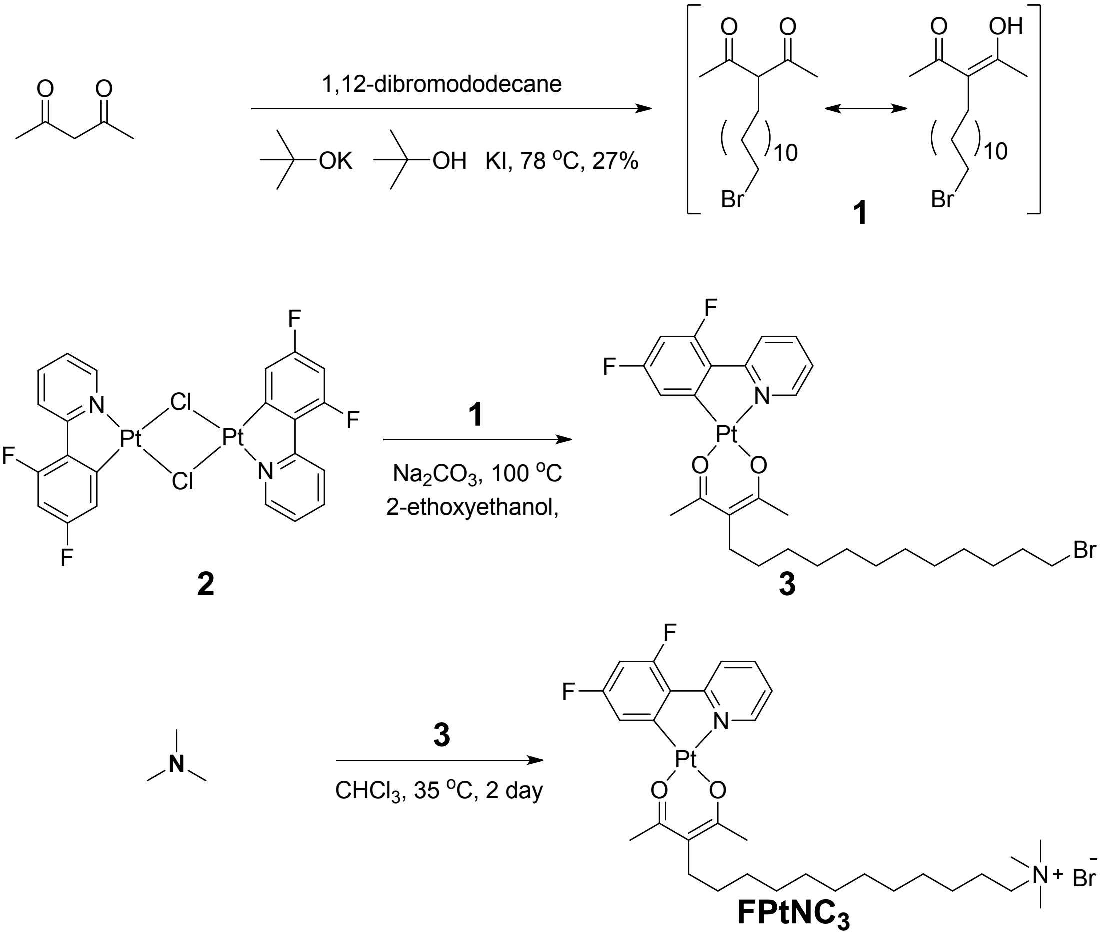
**SEM Experiments**

A drop of aqueous solution of mixture was placed on a glass slide and dried at room temperature. A conductive cover was coated before the SEM images were collected.

**TEM Experiments**

Bright-field TEM images were obtained with a FEI Tecnai F30 operating at 300 kV. A drop of aqueous solution of mixture was placed on a carbon coated copper grid, and dried at room temperature.

## 2. Synthetic route of FPtNC$_3$ complex



Scheme 1 Synthetic route of FPtNC$_3$ complex

***1) Synthesis of 1***. A mixture of 1, 12-Dibromododecane (9.84 g, 0.03 mol, 1 eq), Potassium tert-butoxide (3.37 g, 0.03 mol, 1 eq), KI (0.5 g, 0.003 mol, 0.1 eq), were dissolved in tert-Butanol (150 mL) under $N_2$. After stirring the solution at room temperature for 5 min, acetylacetone (3.0 g, 0.03 mol, 1 eq) was added slowly over a period of 2 min. Then the reaction mixture was heated to 75°C for 48 h, where complete reaction was observed by thin layer chromatography. After cooling, water was added and washed with $CH_2Cl_2$ and dried over anhydrous $MgSO_4$, filtered and concentrated. The product was purified using silica gel chromatography (petroleum ether/EtOAc, v/v, 100/1) to give a colourless viscous liquid (27.0 % yield).

$^1$H NMR (400 MHz, $CDCl_3$, $Me_4Si$): $\delta$ 16.70 (s, 0.4H, CO*H* enol-form), 3.61 (t, 0.5H, COCHCO, keto-form), 3.41 (t, 2H, *J* = 7 Hz, *CH$_2$*Br), 2.20-2.23 (m, 1.1H, enol form *CH$_2$*(CH2)$_{11}$Br), 2.17 (s, 3H, *CH$_3$*COCHCO*CH$_3$*, keto-form), 2.13 (s, 3H, *CH$_3$*COCHCO*CH$_3$*, enol-form), 1.80-1.89 (m, 1.3H, CH*CH$_2$*$(CH_2)_{11}$Br, keto-form; 2H, e, *CH$_2$*$CH_2$Br), 1.26-1.42 (m, 18H, $BrCH_2CH_2$(*CH$_2$*)$_8$).

$^{13}$C NMR (100 MHz, $CDCl_3$, $Me_4Si$): $\delta$ 204.43, 190.82, 110.49, 68.90, 33.95, 32.71, 30.58, 29.50, 29.45, 29.40, 29.31, 29.17, 28.97, 28.64, 28.22, 28.05, 27.49, 27.44, 22.76.

HR-ESI-MS m/z : calcd $[C_{17}H_{32}BrO_2]^+$ : 347.1580; found $[C_{17}H_{32}BrO_2]^+$ : 347.1583.

***2) Synthesis of 2***. **2** was synthesized by the literature methods.[1]

***3) Synthesis of 3***. A mixture of **1** (2.5 g, 7.2 mmol, 2.5 eq), **2** (2.4 g, 2.85 mmol, 1 eq), and

$Na_2CO_3$ (3.0 g, 28.3 mmol, 10 eq) in 2-ethoxyethanol (50 mL), was sealed under $N_2$ and heated to 100°C for 16 h. The cooled mixture was diluted in $CH_2Cl_2$ and filtered, the solvent was removed under reduced pressure, and the compound was purified by flash chromatography (petroleum ether/dichloromethane, v/v, 10/1). The product was recrystallized with dichloromethane/methanol (20.0% yield).

$^1H$ NMR (400 MHz, $CDCl_3$, $Me_4Si$): $\delta$ 1.25-1.43 (m, 18H, $BrCH_2CH_2(CH2)_8$), 1.82-1.87 (m, 2H, $CH_2CH_2Br$), 2.14, 2.16 (2s, 6H, $CH_3COCHCOCH_3$), 2.32 (t, $J$ = 8 Hz, 2H, $CH_2(CH_2)_{11}Br$), 3.42 and 3.54 (2 × t, $J$ = 8 Hz, 2H, $CH_2Br$), 6.53-6.60 (m, 1H), 7.09-7.14 (m, 2H), 7.82 (t, $J$ = 8 Hz, 1H), 7.95 (d, $J$ = 8 Hz, 1H), 8.97 (d, $J$ = 8 Hz, 1H).

$^{13}C$ NMR (100 MHz, $CDCl_3$, $Me_4Si$): $\delta$ 184.73, 182.58, 165.15 (d, $J$ = 8 Hz), 161.27, 158.52 (d, $J$ = 13 Hz), 146.98, 144.66, 144.62 (d, $J$ = 8 Hz), 138.42, 128.10 (q, $J$ = 2 Hz), 122.17 (d, $J$ = 18 Hz), 120.91, 112.13, 99.00 (t, $J$ = 27 Hz), 45.21, 34.10, 32.81, 32.63, 30.97, 30.91, 29.90, 29.67, 29.58, 29.52, 29.45, 29.41, 28.87, 28.75, 28.16, 27.58, 26.87, 26.77.

HR-ESI-MS m/z : calcd $[C_{28}H_{36}BrF_2NO_2PtNa]^+$ : 754.1402; found $[C_{28}H_{36}BrF_2NO_2PtNa]^+$ : 754.1437.

***4) Synthesis of FPtNC$_3$.*** Under a nitrogen atmosphere complex **3** (0.26 g, 0.36 mmol, 1 eq) was dissolved in $CHCl_3$ (7 mL) followed by the addition of trimethylammonium (3.1 g, 17.3 mmol, 46 eq), the reaction mixture was stirred at 35°C for three days. After cooling, the $CHCl_3$ was removed under reduced pressure, the compound was purified by flash chromatography (petroleum ether/dichloromethane, v/v, 20/1), then was recrystallized by diffusing diethyl ether to **4** in $CH_2Cl_2/CH_3OH$ to get yellow solid (40% yield).

$^1H$ NMR (400 MHz, $CDCl_3$, $Me_4Si$): $\delta$ 1.25-1.41 (m, 18H, $CH_2(CH_2)_9CH_2CH_2N^+$), 1.71 (m, 2H, $CH_2CH_2N^+(CH_3)_3$), 2.14 and 2.16 (2s, 6H, $CH_3COCHCOCH_3$), 2.32 (t, $J$ = 8 Hz, 2H, $CH_2(CH_2)_{11}N^+(CH_3)_3$), 3.42 (s, 9H, $CH_2N^+(CH_3)_3$), 3.54-3.58 (m, 2H, $CH_2N^+$), 6.53-6.59 (m, 1H), 7.07-7.12 (m, 2H), 7.82 (t, $J$ = 8 Hz, 1H), 7.95 (d, $J$ = 8 Hz, 1H), 8.97(d, $J$ = 8 Hz, 1H).

$^{13}C$ NMR (100 MHz, $CDCl_3$, $Me_4Si$): $\delta$ 184.58 (s), 182.16 (s), 164.74 (d, $J$ = 6 Hz), 160.95, 160.83, 158.38, 146.74, 144.73, 144.65, 138.27, 128.10 (q, $J$ = 2 Hz), 121.83 (d, $J$ = 7 Hz), 120.85, 111.94, 98.70 (t, $J$ = 27 Hz), 66.63, 53.15, 30.81, 30.73, 29.71, 29.45, 29.34, 29.24, 29.18, 29.04, 27.41, 26.63, 25.94, 23.01.

HR-ESI-MS m/z : calcd $[C_{31}H_{45}F_2N_2O_2Pt]^+$: 710.3094; found $[C_{31}H_{45}F_2N_2O_2Pt]^+$: 710.3093.

## 3. Spectrum Analysis

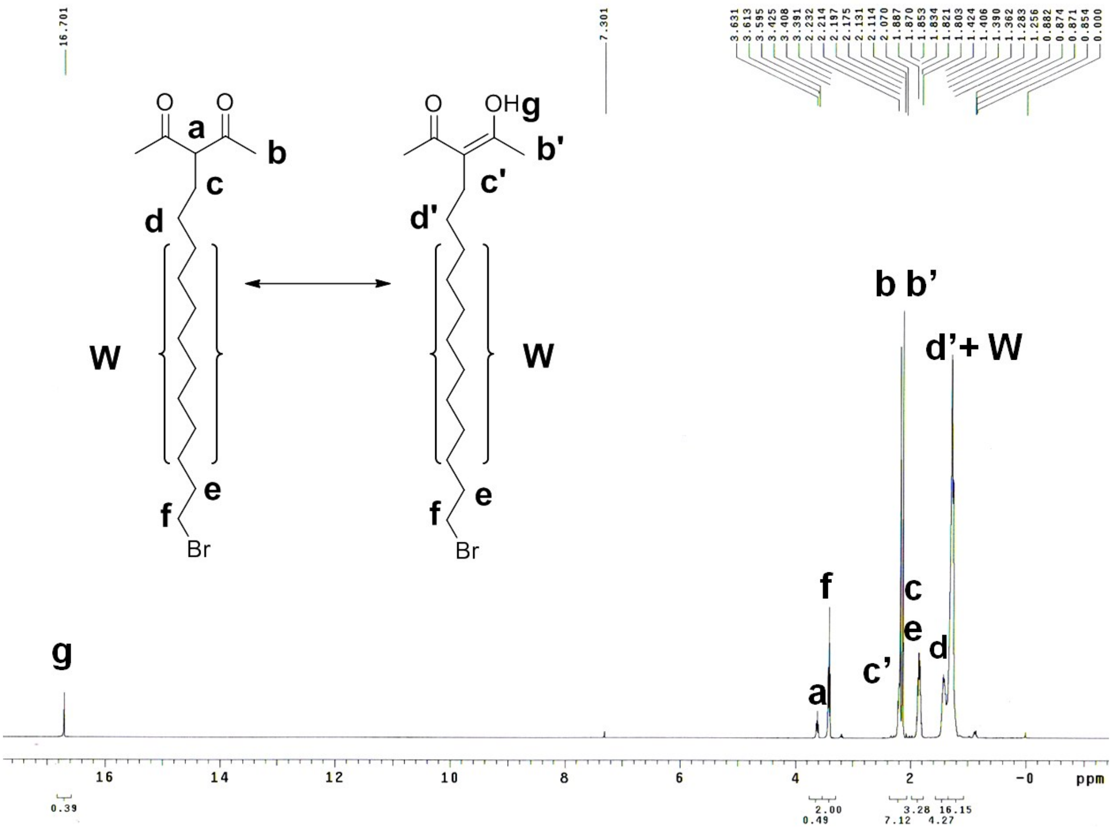


Figure S1 The $^1$H NMR of complex **1**

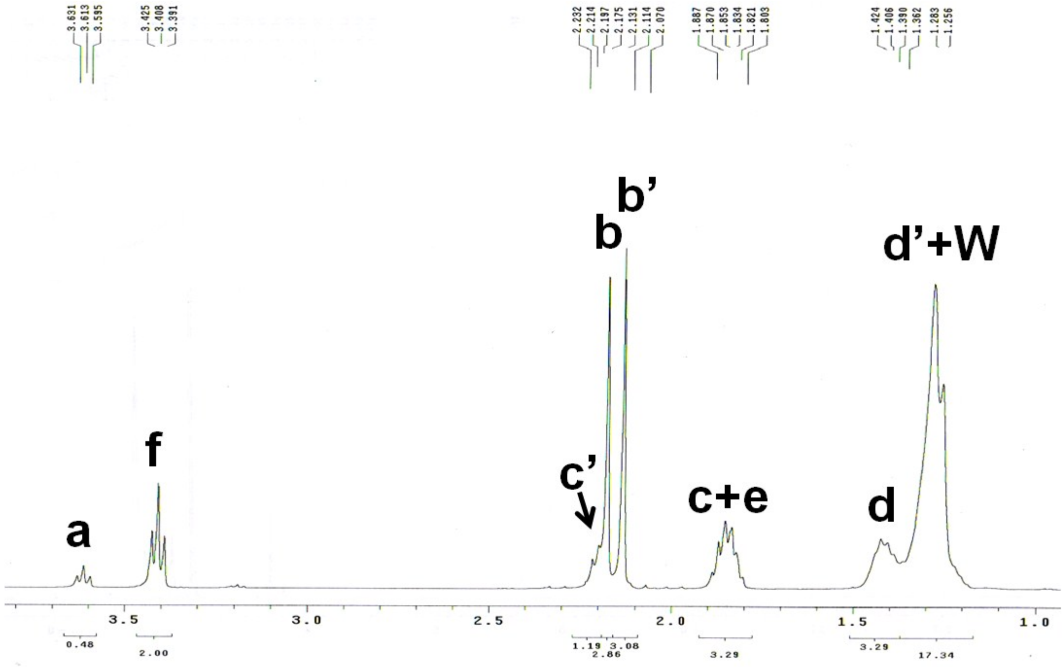


Figure S2 A part of $^1$H NMR of complex **1**

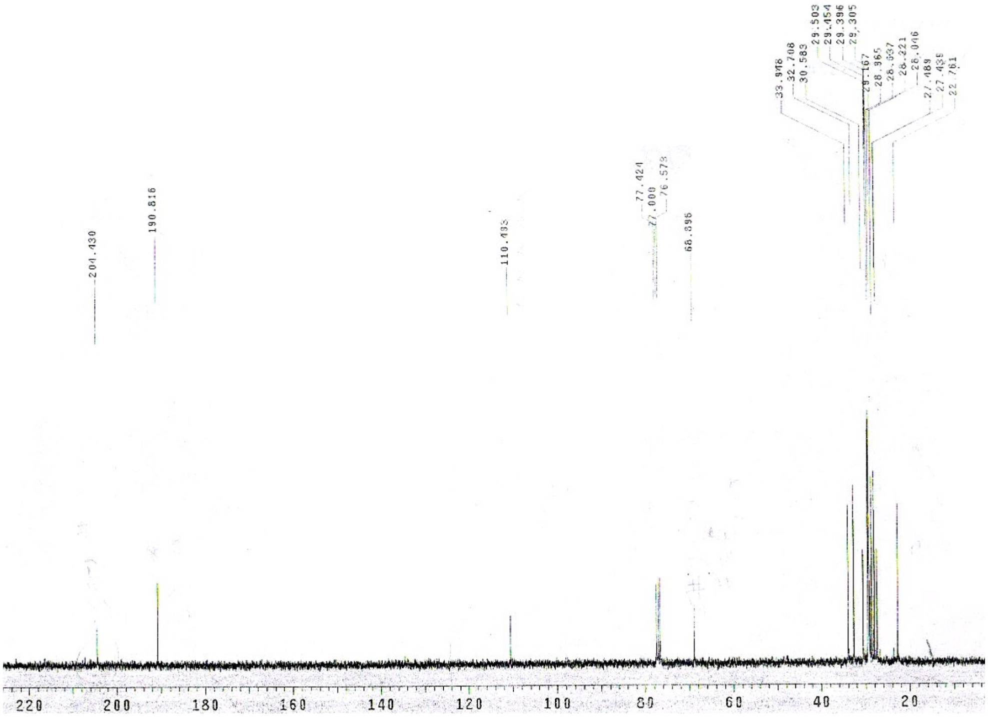


Figure S3 The $^{13}C$ NMR of complex **1**

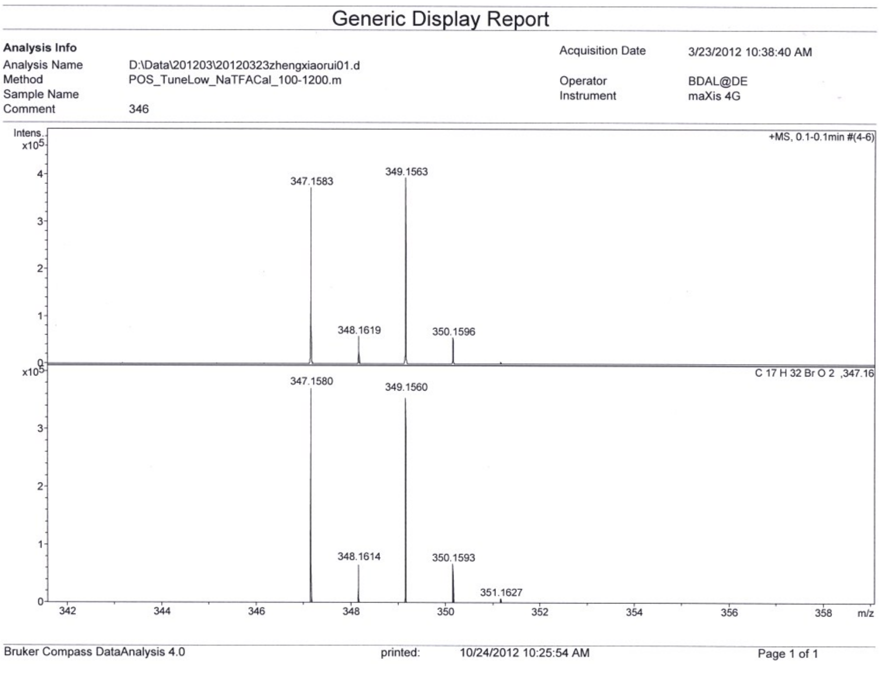


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Figure S4 The HR-ESI-MS of complex **1**

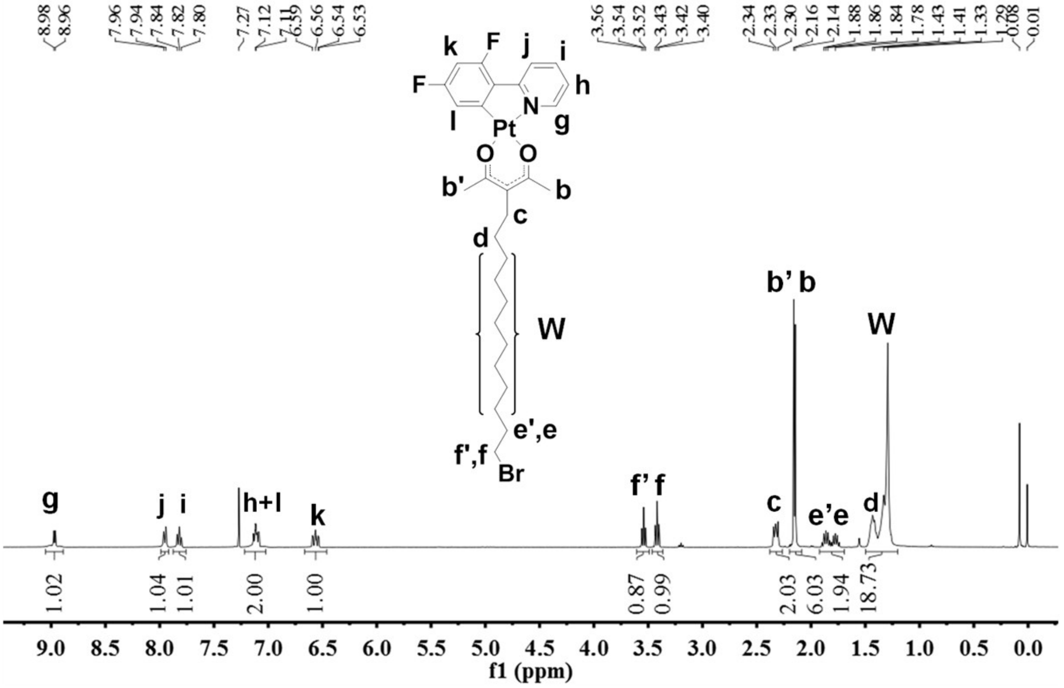

Figure S5 The $^{1}$H NMR of complex **3**

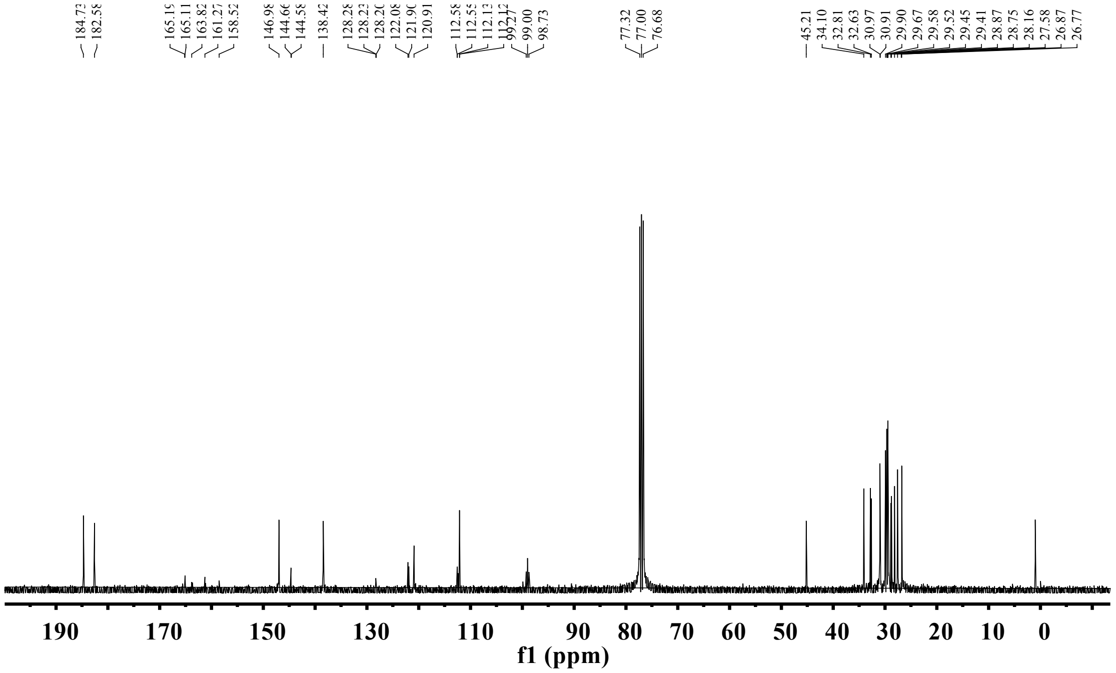

Figure S6 The $^{13}$C NMR of complex **3**

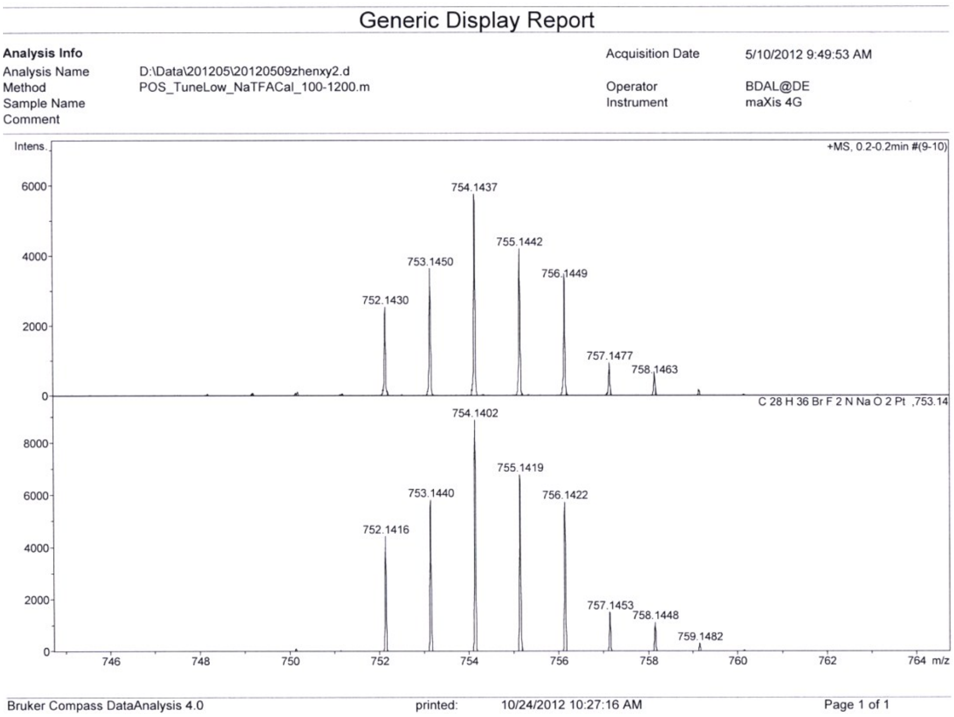

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Figure S7 The HR-ESI-MS of complex **3**

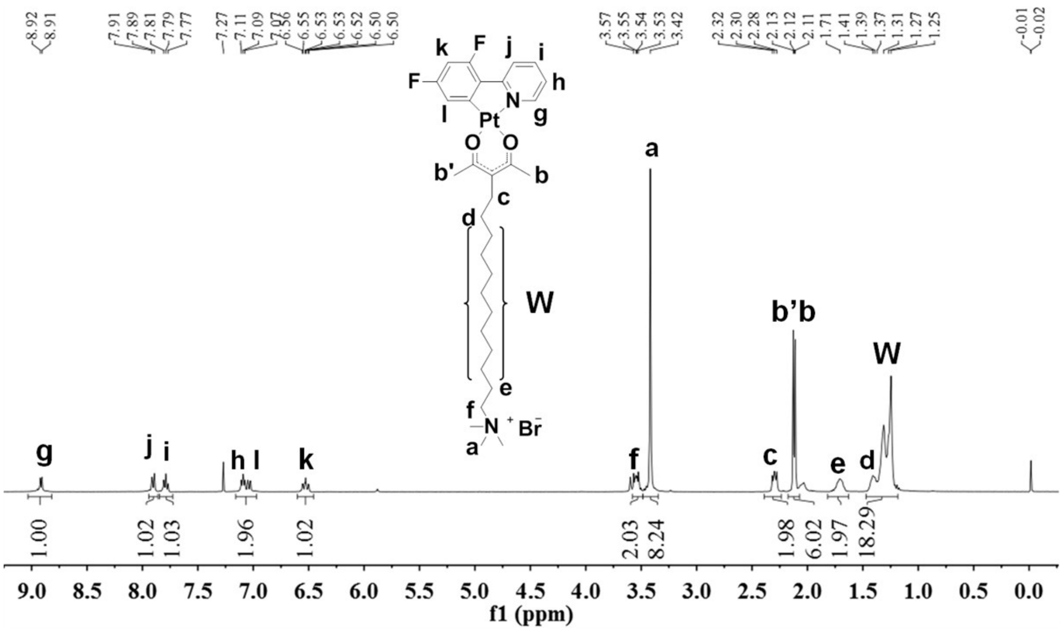


Figure S8 The $^1H$ NMR of $FPtNC_3$

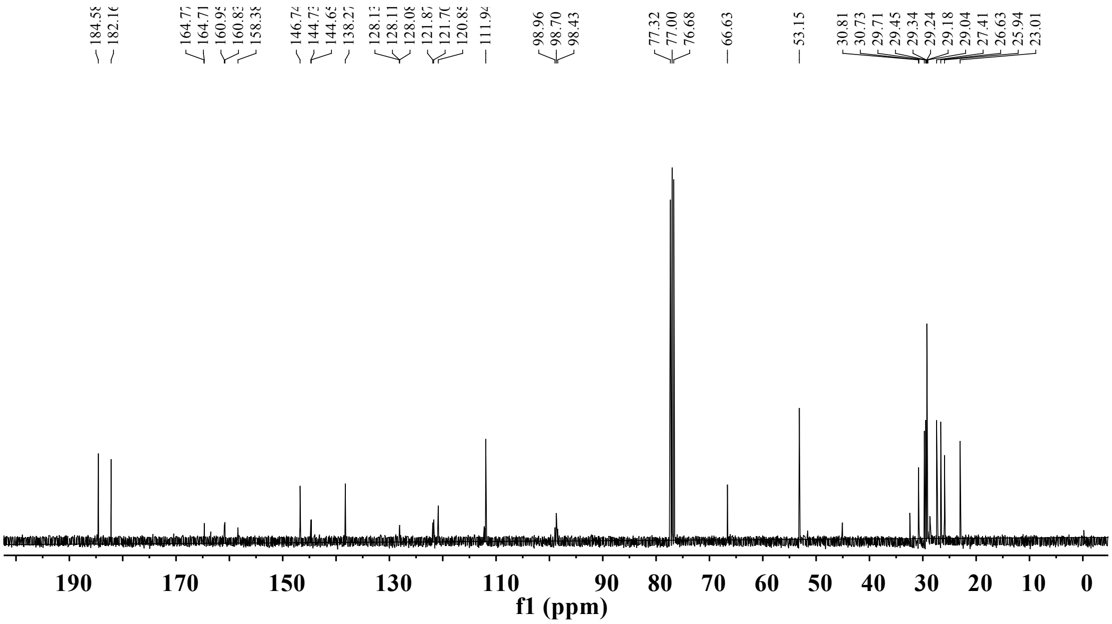
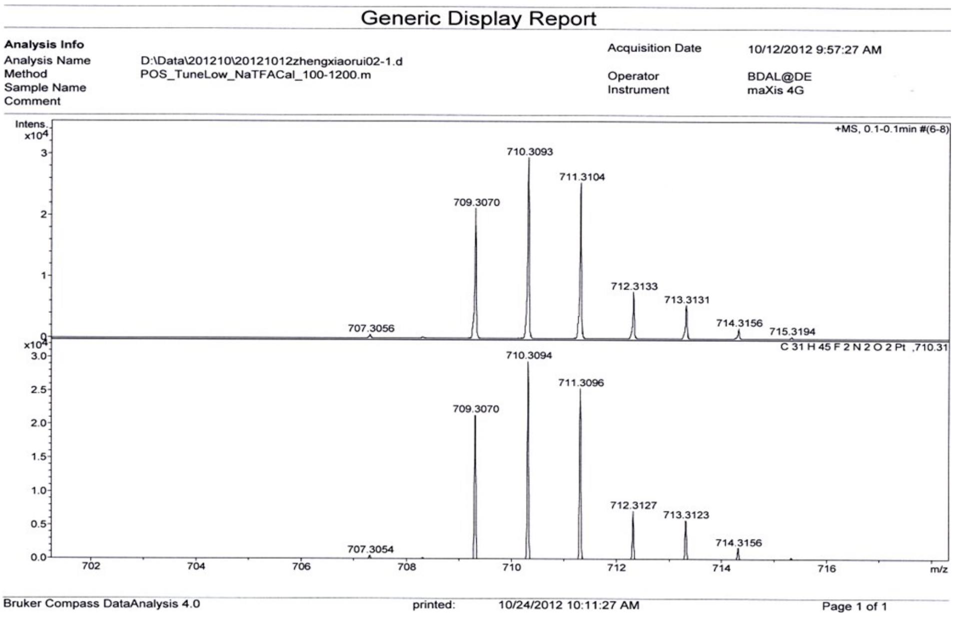


Figure S9 The $^{13}C$ NMR of FPtNC$_3$



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Instrument maXis 4G

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Figure S10 The HR-ESI-MS of FPtNC$_3$

## 3. Self-assembly of FPtNC$_3$ and FPtNC$_3$/DTAB mixtures in water

### Solution Preparation

The concentration of FPtNC$_3$ aqueous solution was maintained at 0.2 mM. The samples of assemble systems were prepared by adding the DTAB aqueous solution to FPtNC$_3$ solution and aging for several months to get suspension solutions. Longer aging do not result in change in samples. Assemble and some measurements were repeated to ensure the reproducibility.

**Table 1** The molar ratio of FPtNC$_3$/DTAB mixture systems and concentrations in detail.

| The molar ratio of $FPtNC_3$/DTAB | The volume of $FPtNC_3$ (0.2 mM) / mL | The volume of DTAB | | Total concentration / mM | Total wt% | The percent of $FPtNC_3$ |
|---|---|---|---|---|---|---|
| | | (0.02 M) / μL | (0.2 M) / μL | | | |
| 1 : 0 | 4 | 0 | 0 | 0.20 | 13.6 | 100% |
| 1 : 1 | 4 | 40 | 0 | 0.40 | 18.0 | 50% |
| 1 : 2 | 4 | 80 | 0 | 0.59 | 21.8 | 33.3% |
| 1 : 3 | 4 | 0 | 12 | 0.80 | 25.5 | 25% |
| 1 : 4 | 4 | 0 | 16 | 0.99 | 28.8 | 20% |
| 1 : 5 | 4 | 0 | 20 | 1.19 | 31.6 | 16.7% |
| 1 : 6 | 4 | 0 | 24 | 1.39 | 34.4 | 14.3% |
| 1 : 7 | 4 | 0 | 28 | 1.59 | 37.0 | 12.5% |
| 1 : 8 | 4 | 0 | 32 | 1.79 | 39.2 | 11.1% |
| 1 : 9 | 4 | 0 | 36 | 1.98 | 41.4 | 10.0% |
| 1 : 10 | 4 | 0 | 40 | 2.18 | 43.3 | 9.09% |
| 1 : 20 | 4 | 0 | 80 | 4.11 | 57.7 | 4.76% |
| 1 : 30 | 4 | 0 | 120 | 5.96 | 66.1 | 3.23% |
| 1 : 40 | 4 | 0 | 160 | 7.88 | 71.6 | 2.44% |
| 1 : 50 | 4 | 0 | 200 | 9.71 | 75.5 | 1.96% |
| 1 : 60 | 4 | 0 | 240 | 11.5 | 78.4 | 1.64% |
| 1 : 70 | 4 | 0 | 280 | 13.3 | 80.7 | 1.41% |
| 1 : 80 | 4 | 0 | 320 | 15.0 | 82.3 | 1.23% |
| 1 : 90 | 4 | 0 | 360 | 16.7 | 84.0 | 1.10% |
| 1 : 100 | 4 | 0 | 400 | 18.4 | 85.2 | 0.99% |

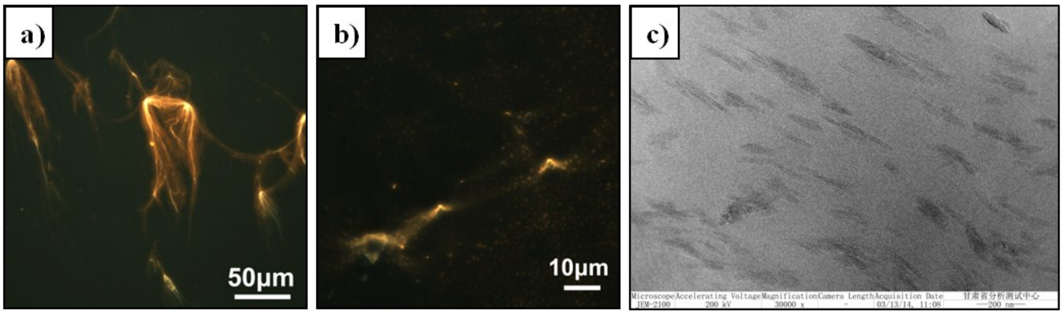

Figure S11 Fluorescent micrograph of $FPtNC_3$ in aqueous solution(a) and in dry state(b), (c)TEM image of $FPtNC_3$ in dry state on carbon casted copper grid.

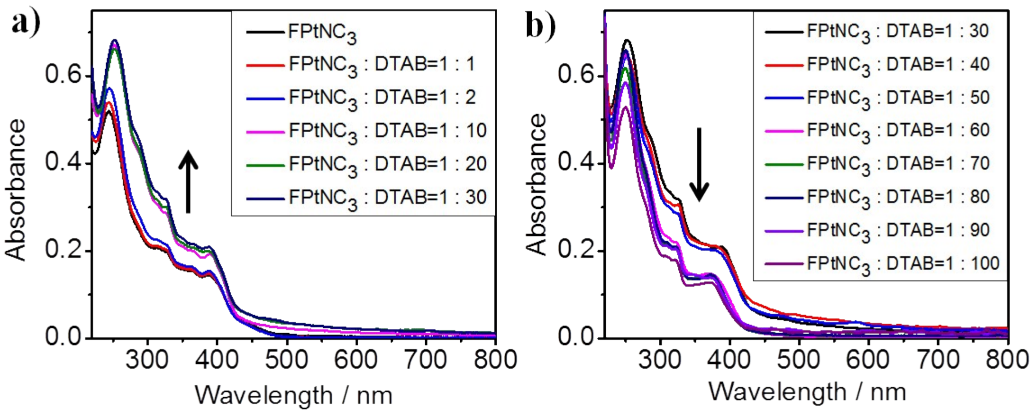

Figure S12 UV-Vis spectrum of FPtNC$_3$/DTAB mixture systems.

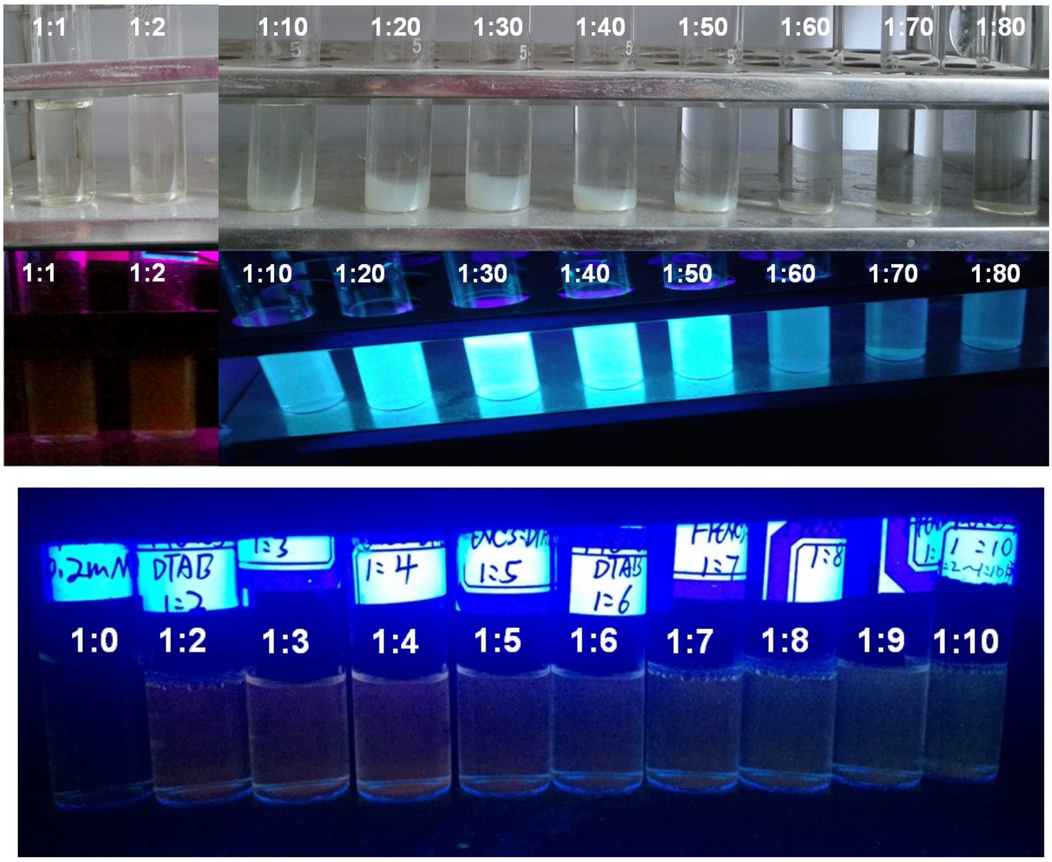

Figure S13 Photographic images of mixture systems excited at 365 nm wave length with a UV lamp.

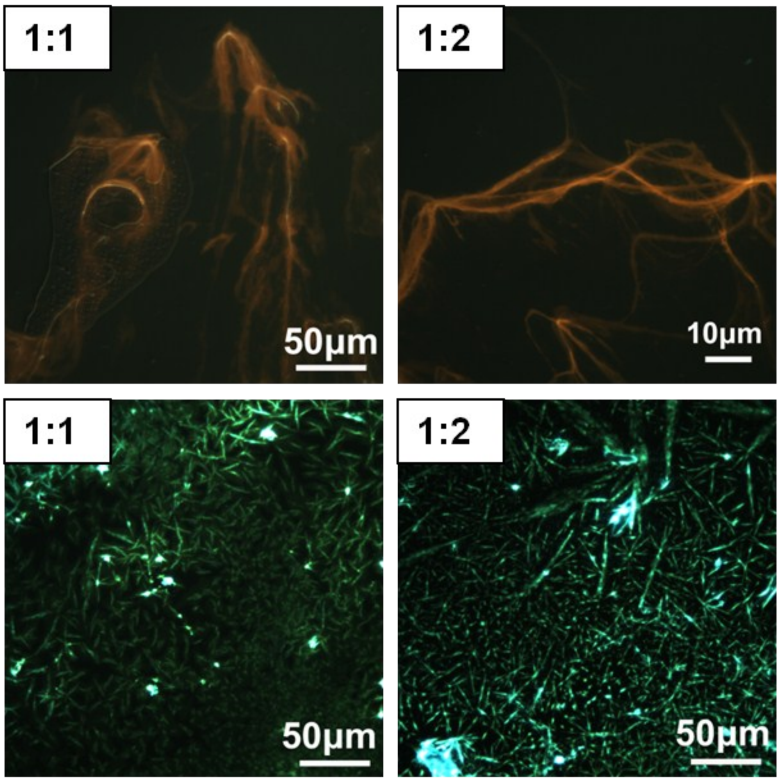

Figure S14 Fluorescent micrograph of FPtNC$_3$/DTAB mixture systems with molar ratio at 1:1 and 1:2 in aqueous solution(up) and in dry state(down).

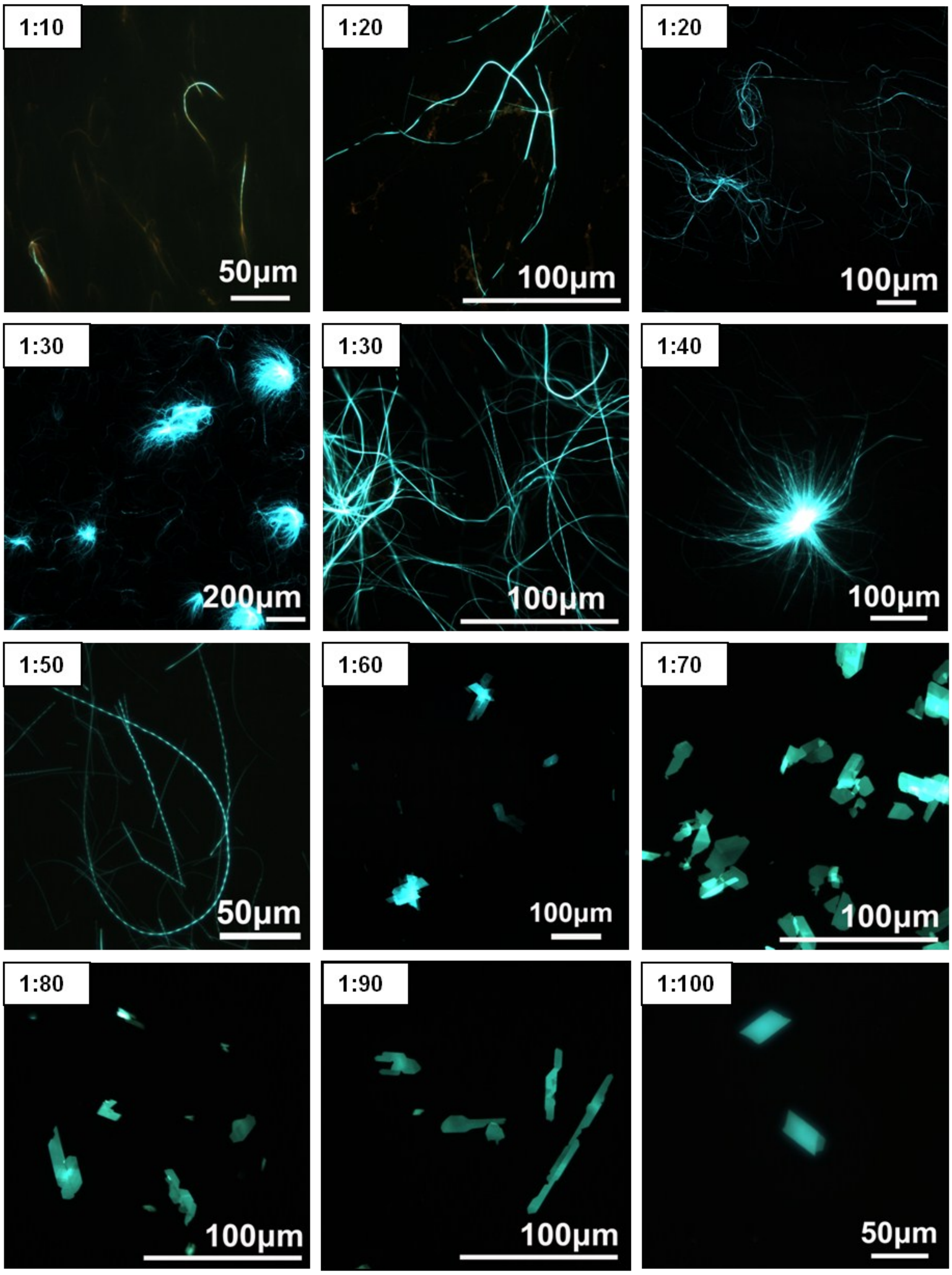

Figure S15 Fluorescent micrograph of FPtNC$_3$/DTAB mixture systems in aqueous medium.

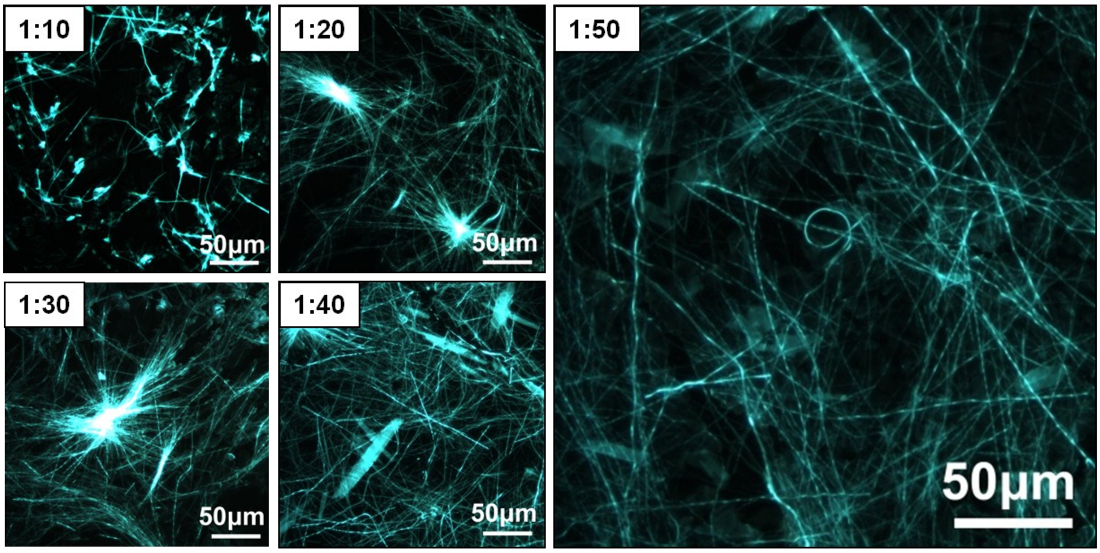

Figure S16 Fluorescent micrograph of FPtNC$_3$/DTAB mixture systems in dry state.

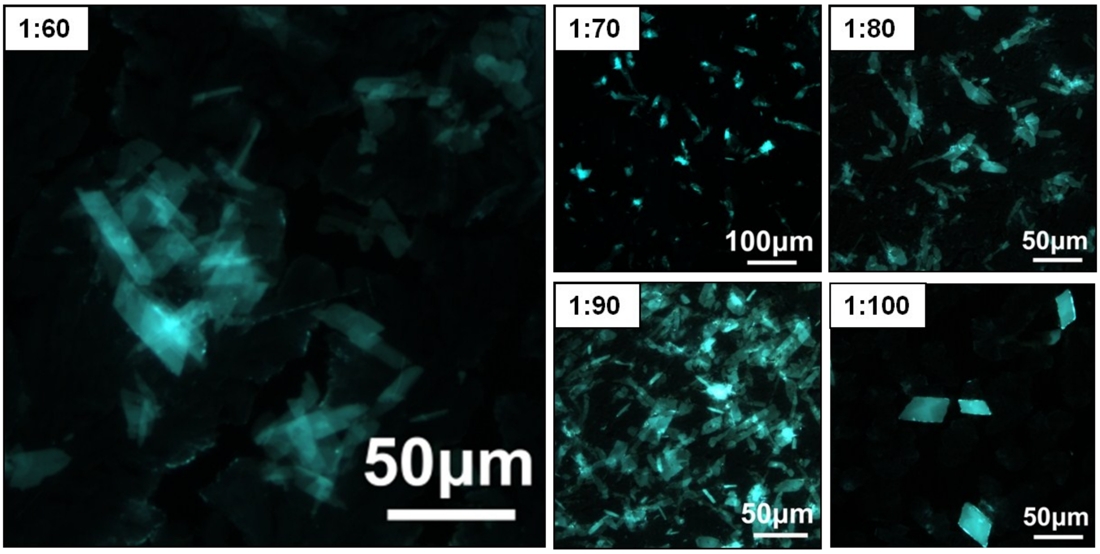

Figure S17 Fluorescent micrograph of FPtNC$_3$/DTAB mixture systems in dry state.

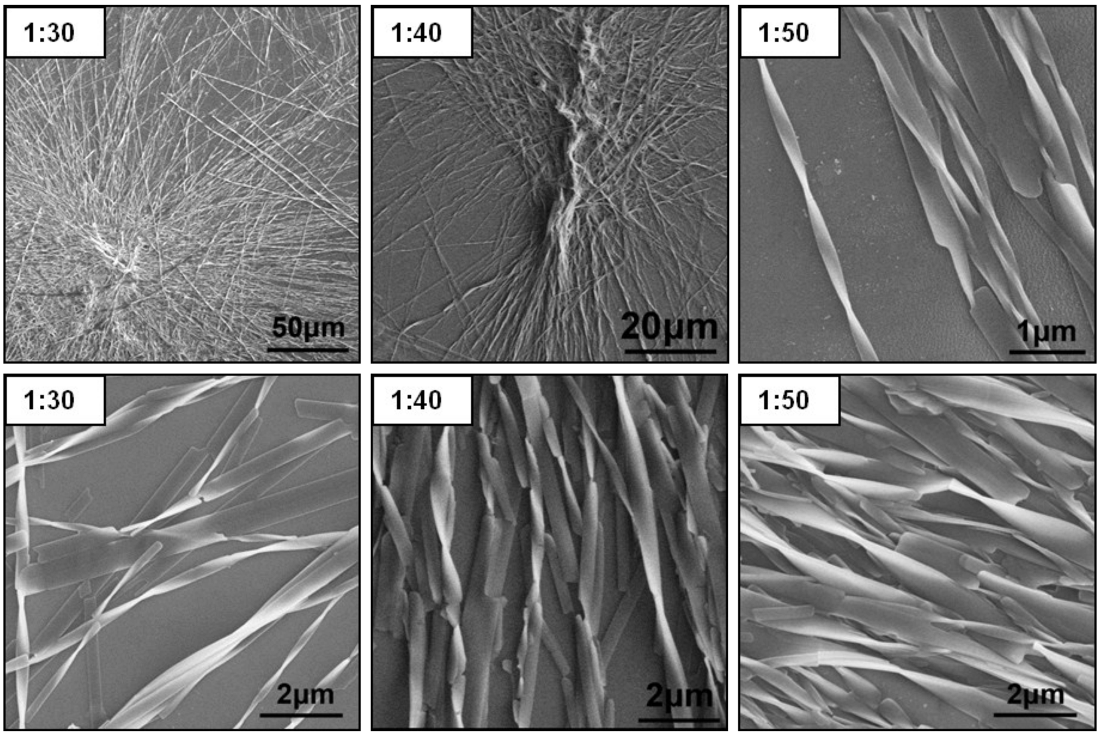

Figure S18 SEM images of FPtNC$_3$/DTAB mixture systems.

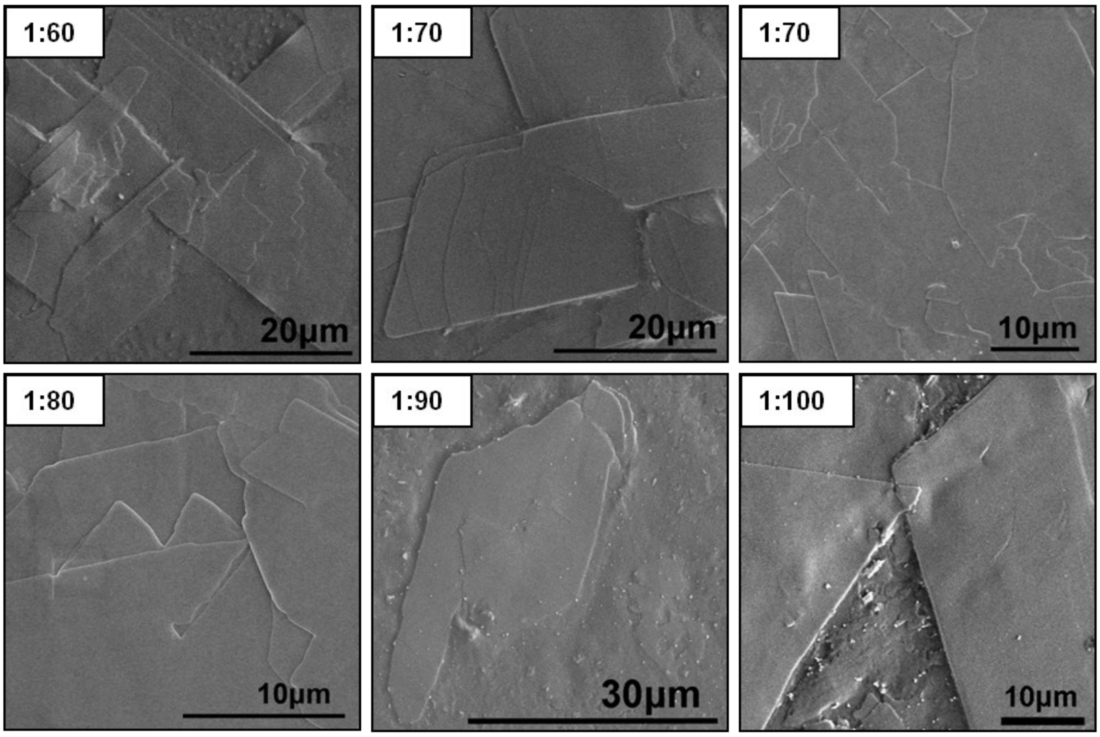

Figure 19 SEM images of FPtNC$_3$/DTAB mixture system.

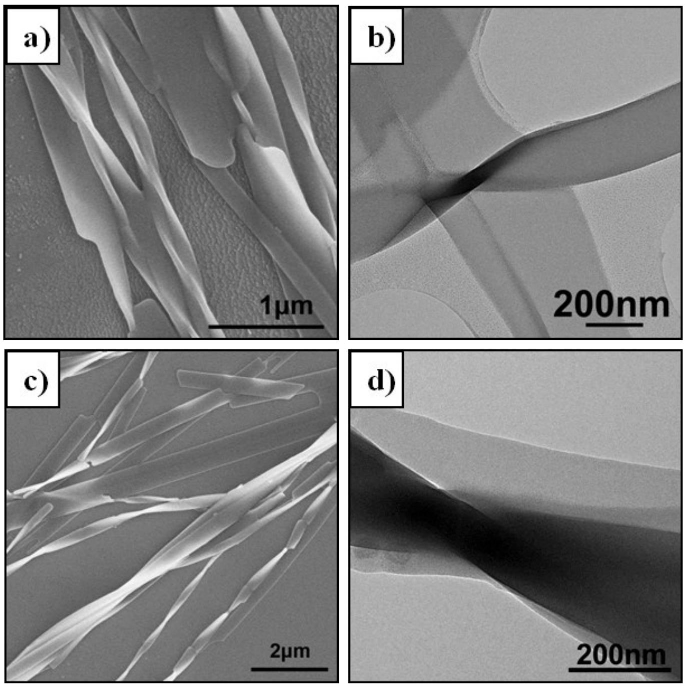

Figure S20 SEM images of $FPtNC_3$/DTAB mixture system with left hand(a, b), right hand(c, d) helices and a few straight ribbons.

## References:

1 J. Brooks, Y. Babayan, S. Lamansky, P. I. Djurovich, I. Tsyba, R. Bau and M. E. Thompson, *Inorg. Chem.*, 2002, **41**, 3055.