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ARTICLE

N-Unsubstituted-1,2,3-triazole-tethered, AIEE Type Conjugated Polymer as Ratiometric Fluorescence Probe for Silver Ion[†]

Wei Shi^{a*}, Xinhua Sun^b, Shiyu Zhao^b, Zhengfeng Xie^{a*}

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A type of *N*-unsubstituted-1,2,3-triazole-decorated conjugated polymer (**P3**), which with the feature of aggregation-induced emission enhancement (AIEE), was successfully synthesized *via* Cu⁺-catalyzed Click reaction between the acetylene-substituted precursor polymer (**P2**) and azidotrimethylsilane. Except for Ag⁺, the introduction of other metal ions brought slight influence to the optical properties of **P3**. With the introduction of aqueous Ag⁺, fluorescence of **P3** in THF-water mixture (V_{THF}/V_{Water} = 4/1) (buffered with Tris-CA, 1 mM, pH=7.4) displayed ratiometric alteration at blue (~ 420 nm) and green (~ 495 nm) bands. Corresponding I₄₉₅/I₄₂₀ ratio values remained upward trend throughout the titration process of Ag⁺. The detection limit of Ag⁺ reaches ~ 1.4 μM (3σ/k), as evaluated from the corresponding relationship between I₄₉₅/I₄₂₀ and [Ag⁺]. The aggregation between polymer chains induced by Ag⁺-triazole interrelation is the plausible reason for the alteration of **P3**'s optical properties.

Introduction

With the rapid development of human society, silver ion (Ag⁺) has been extensively utilized in electronic, photographic, imaging and pharmaceutical industries, etc.¹ Despite of the sterilization function of Ag⁺, recent investigations have discovered that Ag⁺ can cause severe damage to both environment and human beings.²⁻⁴ Ag⁺ can inactivate enzymes and accumulate in the body, and the concentration higher than 0.9 μM would be toxic for human.^{5,6} Excessive intake of Ag⁺ can lead to long-term insoluble substrates formed in eye and skin cells.⁷ Therefore, it is of great significance to develop selective, sensitive and practice-simple detection method for Ag⁺.

By comparing with other traditional Ag⁺ detection methods, such as atomic absorption, plasma emission spectroscopy, anodic stripping voltammetry and potentiometry, etc.,⁸⁻¹⁰ optical probing for Ag⁺ displayed some attractive advantages, such as good selectivity, low detection limit, convenience in sample preparation and relative low-cost of related equipments.¹¹⁻¹³ Despite of the available advances Ag⁺ optical probes have been achieved, two main obstacles are still laying before the further application and improvement of these probes. The first

one is based on the fact that Ag⁺ has moderate coordination ability; it is difficult to be discriminated from other similar heavy metal ions thus.^{14,15} The second one is that Ag⁺ is a type of so-called "silent ion" and most of reported Ag⁺ probes were based on the fluorescence quenching mechanism.^{16,17} Although several fluorescence turn-on type Ag⁺ probes have been reported recently,¹⁸⁻²² room still left to make further improvement.

As compared to fluorescence turn-off and turn-on probes, fluorescence ratiometric probes are more attractive due to the simultaneous signal-output at two-wavelength channels, better anti-interference and built-in correction for external environmental effects.^{23,24} However, there are only few presentations about the investigation of ratiometric fluorescence Ag⁺ probes by far, and most of these probes were based-on small-molecule platforms.²⁵⁻³⁰ As compared to small molecular optical probes, conjugated polymers (CPs) based probes displayed impressive superiority at detection sensitivity, which stems from the unique signal-amplification characteristic of them.³¹⁻³³ By the introduction of Ag⁺-targeting segments, such as quinoxaline,^{14,34} quinoline,³⁵ pyridyl,³⁶ biimidazole,^{37,38} ethyl-2-(2-(pyridin-2-yl)-1H-benzo[d]imidazol-1-yl) acetate,¹⁵ aspartic acid³⁹ and other groups⁴⁰⁻⁴² into CPs, the selective optical response toward Ag⁺ was successfully achieved. However, it is a pity that most of these reported CPs-based Ag⁺ probes were based on fluorescence turn-off mode. To the best of our knowledge, CP-based fluorescence ratiometric Ag⁺ probe was scarcely explored by far.³⁸ The relating work will provide good complement for the development of CPs-based Ag⁺ probe.

In this current effort, a type of well-known Ag⁺-coordinative agent, 1,2,3-triazole,⁴³ was successfully introduced into a type of aggregate-induced emission enhancement (AIEE) featured

^a Oil & Gas Field Applied Chemistry Key Laboratory of Sichuan Province, School of Chemistry and Chemical Engineering, Southwest Petroleum University, Chengdu, 610500, China

^b Key Laboratory of Petroleum and Gas Fine Chemicals, Educational Ministry of China, School of Chemistry and Chemical Engineering, Xinjiang University, Urumqi 830046, P. R. China

* corresponding author: Tel: +86 028 83037306; fax: +86 028 83037305

E-mail address: shiwei80@swpu.edu.cn, xjuwshi@gmail.com (Wei Shi)

xiezfhf@swpu.edu.cn (ZF Xie)

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CP. This CP, referred as **P3**, displayed distinctive ratiometric fluorescence alteration toward Ag^+ . The relating probing properties were systematically investigated here.

Experimental

Materials

All reagents, unless otherwise specified, were purchased from Adamas-beta Chemical Co. and used without further purification. Diisopropylamine, toluene and tetrahydrofuran (THF) were distilled from sodium at the presence of benzophenone and degassed before use. **P1** and **P2** were synthesized as the reported procedures in our recent report.⁴⁴ Solutions of Ag^+ , Al^{3+} , Ba^{2+} , Cu^{2+} , Ca^{2+} , Mg^{2+} , Pb^{2+} , Ni^{2+} , Co^{2+} , Fe^{3+} , Cd^{2+} and Zn^{2+} were prepared from their nitrate salts; Hg^{2+} was prepared from its acetate salt. Concentration of metal solutions was controlled at 10^{-1} M in deionized water and was diluted subsequently to different concentration stocks for next use.

Measurements and Characterization

IR spectra were recorded on an EQUINOX 55 FT-IR spectrometer with KBr pellets. ^1H NMR spectra were collected on a VARIAN INOVA-400 spectrometer operating at 400 MHz (for ^1H) in deuterated chloroform solution with tetramethylsilane as reference. Number-average (M_n) and weight-average (M_w) molecular weights were determined by UltiMate3000 in tetrahydrofuran (THF) using a calibration curve of polystyrene standards. UV-visible absorption spectra were recorded on a SHIMADZU UV-2450 UV-vis spectrophotometer. PL spectra were recorded on SHIMADZU RF-5301pc spectrophotometer. Scanning electron microscope (SEM) studies were performed on LEO1430VP. Dynamic light-scattering (DLS) studies were performed on BI-200SM.

Synthesis and preparation

Synthesis of Poly [(9,9-dioctyl)-2,7-fluorene-4-(3,6-carbazol-9-yl)-phenyl-(1,2,3)triazol-1-yl]-co-[(9,9-dioctyl)-2,7-fluorene-1,2-bis(4-phenyl)-1,2-diphenylethene] (P3)

Under nitrogen, **P2** (0.030 g, 0.022 mmol) was added in dry THF (15 mL). CuBr (0.020 g), *N,N,N',N'',N'''*-pentamethyldiethylenetriamine (0.047 g) and azidotrimethylsilane (0.034 g, 0.29 mmol) were added sequentially. The mixture was stirred at 35 °C overnight. The crude product was washed with toluene *via* flash column chromatography, then concentrated and reprecipitated in methanol. Final product was obtained after vacuum drying at 50 °C overnight (0.024 g). Yield: 74%. FT-IR (KBr, cm^{-1}): 3381 (N-H), 3025, 2924, 2851, 1888, 1734, 1605, 1546 (C=N), 1497, 1461, 1363, 1271, 1229, 1110, 808, 698. ^1H NMR (400 MHz, CDCl_3) δ (ppm): 8.56-8.41 (m), 8.17 (m), 8.11-7.28 (m), 2.05 (m), 1.20-0.70 (m).

The control polymers, referred as **P3-1** and **P3-2**, were prepared through the same procedures by adjusting the feed ratios between **P2** and azidotrimethylsilane.

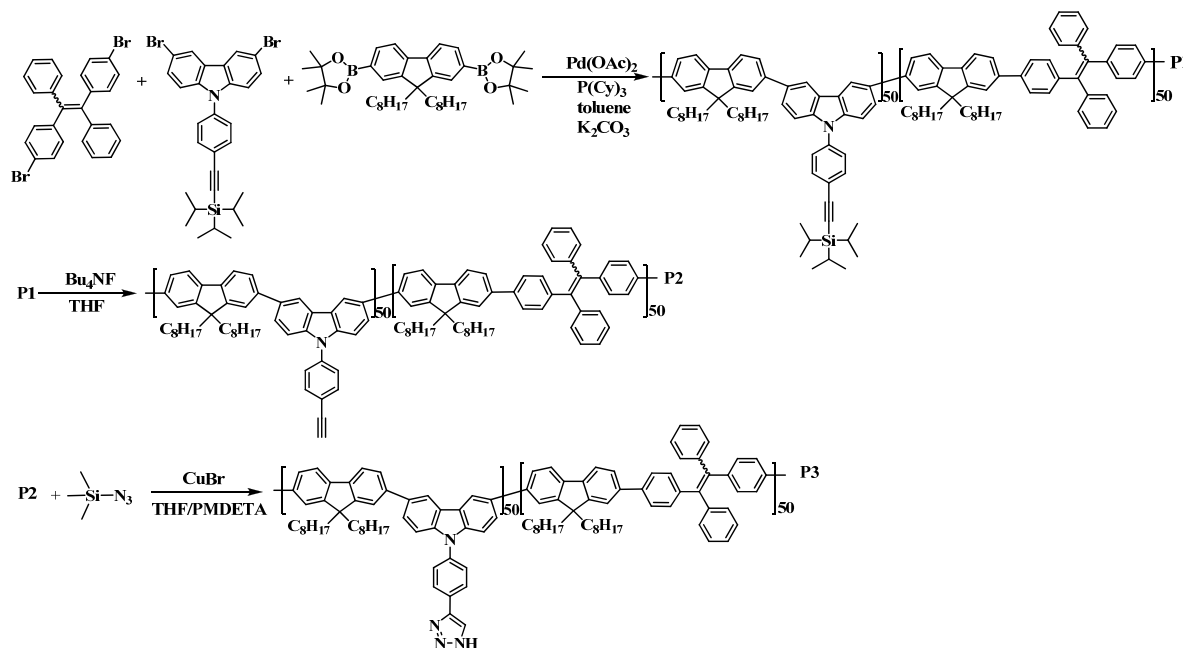
Preparation of P3-Ag⁺ complex

In a flask, **P3** (10 mg) and AgNO_3 (5 mg) were added to the mixture of THF (4 mL) and water (1 mL). The mixture was stirred with 5 min at room temperature. The majority of solvent was evaporated and the precipitate was filtered and washed repeatedly with mixing solvents ($V_{\text{methanol}}/V_{\text{water}}=4:1$). Yellow solid was obtained after vacuum drying at 50 °C for 3 days.

Results and discussion

Synthesis and characterization

The synthetic route of **P3** is displayed in **Scheme 1**. The target polymer, **P3**, was synthesized by Cu^+ -catalyzed Click reaction⁴⁵ between acetylene-substituted precursor polymer (**P2**) and azidotrimethylsilane. The reaction process is composed of the formation of 1,2,3-triazole ring and the in situ removal of trimethylsilane group, as was described in previous literatures about the preparation of *N*-unsubstituted 1,2,3-triazole-containing derivatives.^{46, 47} **P3** displays good solubility in common organic solvents, such as CH_2Cl_2 , CHCl_3 , toluene and THF. Number-averaged molecular weight (M_n) of **P3** was evaluated by gel-permeation chromatography (GPC) analysis, to be 12800 g/mol and with the polydispersity index (PDI) of 2.10.

Scheme 1 Synthetic route of **P3**.

In order to confirm the successful synthesis of **P3**, comparison of FT-IR spectra between **P3** and its precursor polymers (**P1** and **P2**) was made. As shown in Fig. S1, distinct from **P1**, **P2** displays an obvious absorption peak at $\sim 3300\text{ cm}^{-1}$. This absorption signal can be assigned to the stretching vibration of $\equiv\text{C-H}$ according to our previous report.⁴⁴ In the spectrum of **P3**, the absorbance signals at $\sim 3300\text{ cm}^{-1}$ ($\equiv\text{C-H}$) and $\sim 2100\text{ cm}^{-1}$ ($\text{C}\equiv\text{C}$) almost vanish, indicating the remarkable consumption of acetylene groups in the following Click reaction. One can also find that two distinct absorption bands at $\sim 3381\text{ cm}^{-1}$ and $\sim 1546\text{ cm}^{-1}$ appear exclusively in the spectrum of **P3**, which can be ascribed to the stretch vibration of unsubstituted N-H and C=N moieties on the tethered 1,2,3-triazole ring, respectively.

For further to certificate the chemical structure of **P3**, ^1H NMR spectra of polymers are compared in Fig. S2. As reflected by Fig. S2, NMR spectra of **P1**, **P2** and **P3** resemble with each other on the whole. In the spectrum of **P2**, there is a weak proton signal appears at $\sim \delta 3.19\text{ ppm}$, which can be assigned to the acetylene ($\equiv\text{C-H}$) group attached on the polymer backbone. In good agreement with the finding in FT-IR analysis, this acetylene proton signal becomes almost indiscernible in the NMR spectrum of **P3**. Additionally, a distinct proton signal at $\sim \delta 8.17\text{ ppm}$ appears exclusively in the spectrum of **P3**, which might be attributed to the $=\text{C-H}$ proton of triazole-attachments of **P3** (as marked in the spectrum of **P3**).^{46, 47} The other alkyl and aromatic protons signals of **P3** are also reasonable and can

match with its chemical structure. Therefore, FT-IR and ^1H NMR analyses support that **P3** was successfully synthesized.

Optical properties

Taking consideration of the miscibility between THF and water, THF was selected to mix with water to act as co-solvent system for next work. Normalized UV-*vis* absorption and PL spectra (Fig. 1) were measured in THF-water mixture $\{V_{\text{T}}/V_{\text{W}}=4/1$, buffered with tris(hydroxymethyl)aminomethane-citric acid (Tris-CA) solution (1 mM, pH=7.4), this mixture was also selected as the media for the following probing properties investigation $\}$ of **P3** to investigate its optical properties. The absorption peaks at $\sim 350\text{ nm}$, which can be assigned to the $\pi-\pi^*$ transition of polymer backbone. With the excitation of 350 nm, two emission bands, with the emission maxima at $\sim 420\text{ nm}$ and $\sim 495\text{ nm}$, appear in the PL spectrum, which stem from the emission of fluorene-carbazole and fluorene-TPE segments, respectively.^{48, 49}

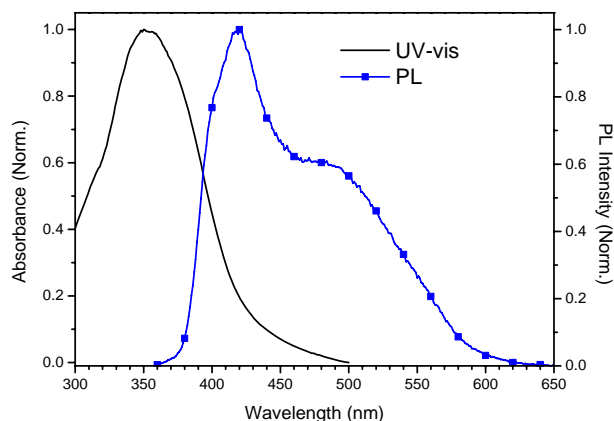


Fig. 1 Normalized UV-vis (a) and PL spectra (b) of **P3** ($\sim 1.5 \times 10^{-5}$ M) in THF-water mixture ($V_{\text{THF}}/V_{\text{Water}}=4/1$) (buffered with Tris-citric acid (Tris-CA), 1 mM, pH=7.4) ($\lambda_{\text{ex}} = 350$ nm).

Aggregation-induced emission enhancement (AIEE) property of **P3**

It's well known that tetraphenylethene (TPE) is a type of representative AIEE active agent, that is, it is virtually non-luminescent when molecularly dissolved in good solvents but emits intensely when aggregated in poor solvents or fabricated into thin solid film.⁵⁰ Considering that TPE has been introduced into **P3**, the AIEE characteristic of **P3** was investigated accordingly in THF (good solvent) and water (poor solvent) mixtures with different mixing ratios. As shown in **Fig. 2**, by excited at 350 nm, the THF solution of **P3** emits blue light, with the emission maximum at ~ 420 nm. With the introduction of water into solvent system, another emission band (with the peak at ~ 495 nm) appears in PL spectra of **P3**. With the increase of water fraction in solvents mixtures, PL intensity of **P3** decreases at ~ 420 nm and increases at ~ 495 nm gradually. The intensity ratio (I_{495}/I_{420}) values increase from ~ 0.20 (in pure THF) to ~ 21.6 (with water fraction up to 90%). This indicates that **P3** is a type of fluorescence ratiometric and AIEE-active polymer. The introduction of water (poor solvent) induces the aggregation of polymer chains, and the intermolecular rotation of TPE segments is thus restricted, which blocks its non-radiative channel and turns on its emission.^{44, 48, 49}

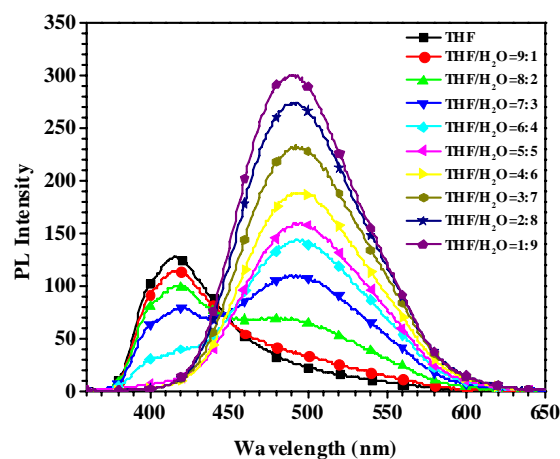


Fig. 2 PL spectra of **P3** ($\sim 1.5 \times 10^{-5}$ M) in THF-water mixtures with different solvent ratios ($\lambda_{\text{ex}} = 350$ nm).

Investigation of **P3**'s probing property

Previous literatures reported that the 1,2,3-triazole group holds the potential to coordinate with some metal ions, and 1,2,3-triazole-containing compounds have been applied to realize the successful detection of metal ions, such as Cd^{2+} , Hg^{2+} , Cu^{2+} , Ag^{+} , etc.⁴³ Considering the involvement of 1,2,3-triazole in **P3**, optical response of **P3** towards metal ions was thus investigated here. As can be seen from **Fig. 3a**, except for Ag^{+} , the addition of other metal ions didn't bring significant influence to the absorption characteristic of **P3**. In the sharp contrast, with the addition of Ag^{+} , as compared to other absorption curves, the intensity of absorbance decreases obviously, accompanied by the broaden of absorption profile and the level-off of absorption onset. As reported in previous literatures, such alteration trend in absorption characteristic is a typical sign of the formation of intermolecular aggregation.⁵¹⁻⁵³

Subsequently, PL response of **P3** toward various metal ions was measured under the same condition. In accordance with the finding in the investigation of absorption response behaviours, the presence of Ag^{+} induces significant alteration of PL properties of **P3**, while the corresponding alteration degrees are much smaller with the introduction of other metal ions (**Fig. 3b**). With the introduction of Ag^{+} , the emission intensity at ~ 495 nm increases significantly, accompanied by the decrease of PL intensity at ~ 420 nm. The corresponding I_{495}/I_{420} values increased from ~ 0.59 (blank solution) to ~ 1.69 (with Ag^{+}) accordingly. This alteration trend of I_{495}/I_{420} values is similar to the water-induced emission ratiometric alteration as discussed in previous section. This suggests once again that the addition of Ag^{+} brought the aggregation of polymer chains. With the help of portable UV lamp (365 nm), Ag^{+} -containing system emits green light, while the blank solution and mixtures with the presence of other metal ions emit blue light. Such strong difference in fluorescence can be distinguished easily by naked eyes (**Fig. 3c**).

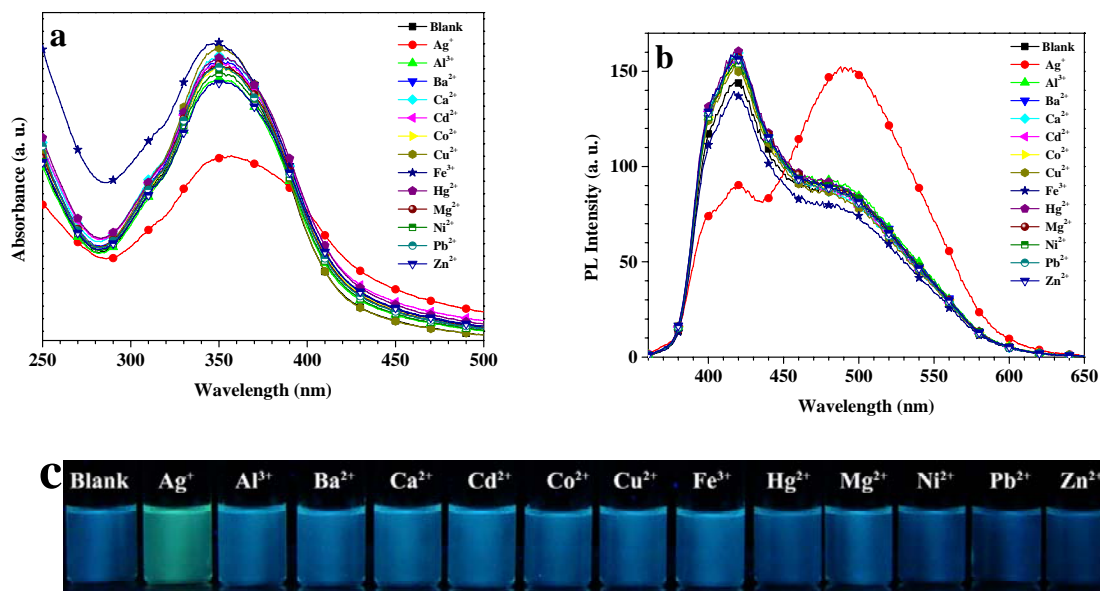


Fig.3 UV-vis (a) and PL spectra (b) of **P3** ($\sim 1.5 \times 10^{-5}$ M) with the presence of various metal ions ($\sim 5.0 \times 10^{-5}$ M) (recorded after 1 min stirring with the addition of metal ion) in THF-water mixture ($V_{\text{THF}}/V_{\text{Water}}=4/1$) (buffered with Tris-CA, 1 mM, pH=7.4) ($\lambda_{\text{ex}}=350$ nm) and corresponding visual photos (c) under UV light (365 nm, provided by portable UV lamp).

Based on the finding that **P3** displays distinctive response to Ag^+ , the detail optical response of **P3** toward incremental Ag^+ was investigated further. As shown in **Fig. 4a**, upon the gradual addition of Ag^+ to the solution, the absorption intensity at ~ 350 nm decreased gradually, accompanied by the broaden of absorption profiles. Corresponding detailed PL response of **P3** toward Ag^+ is displayed in **Fig. 4b**, it reveals the general tendency of ratiometric changes of fluorescence, that is, the decrease at blue band (~ 420 nm) and increase at longer wavelength (~ 495 nm). By carefully analyzing the alteration process of these PL curves, one can note that the PL intensity slightly increased at ~ 420 nm at the early stage of titration (with $[\text{Ag}^+]$ from 0 to 2.5×10^{-6} M), this seems deviates from the overall alteration trend of PL intensity at this emission band. Considering that the aqueous solution of Ag^+ was utilized in our experiment to realize the introduction of Ag^+ , and some water was inevitably introduced into probing system as association agent of Ag^+ . An issue lays before us that how about the influence brought by these extra water? To solve this issue, PL response of **P3** toward pure water was investigated accordingly and the result is displayed in **Fig. S3**. PL intensity at ~ 420 nm increased slightly with the introduction of water alone, this is in accordance with the alteration trend revealed in the initial titration process of Ag^+ . Based on this finding, we speculate that the participation of water is the main reason for

the unexpected alteration at ~ 420 nm at the early stage of titration. With the introduction of more amount of Ag^+ (with $[\text{Ag}^+]$ above 2.5×10^{-6} M), as was expected, PL intensity decreased monotonously at ~ 420 nm. As for the emission at ~ 495 nm, different from the indiscernible alteration brought by pure water (**Fig. S3**), the addition of Ag^+ led to observable enhancement of intensity at this band, even when the concentration of Ag^+ was as low as $\sim 5.0 \times 10^{-7}$ M. The intensity increased monotonously with $[\text{Ag}^+]$ from 5.0×10^{-7} M to $\sim 3.2 \times 10^{-5}$ M, and begun to drop with further addition of Ag^+ . This might be due to the heavy-metal quenching effect brought by free Ag^+ ions in probing system. Fortunately, despite of these unexpected interludes, the corresponding I_{495}/I_{420} ratio values remain upward trend throughout the titration process (**Fig. 4c**); this solidly supports the ratiometric probing of **P3** toward Ag^+ . The detection limit of Ag^+ reaches ~ 1.4 μM ($3\sigma/k$),⁵⁴ as evaluated from the corresponding relationship between I_{495}/I_{420} and $[\text{Ag}^+]$ (with $[\text{Ag}^+]$ in the range of 5.0×10^{-7} M to 7.5×10^{-6} M, $R^2=0.983$) (**Fig. 4c**).

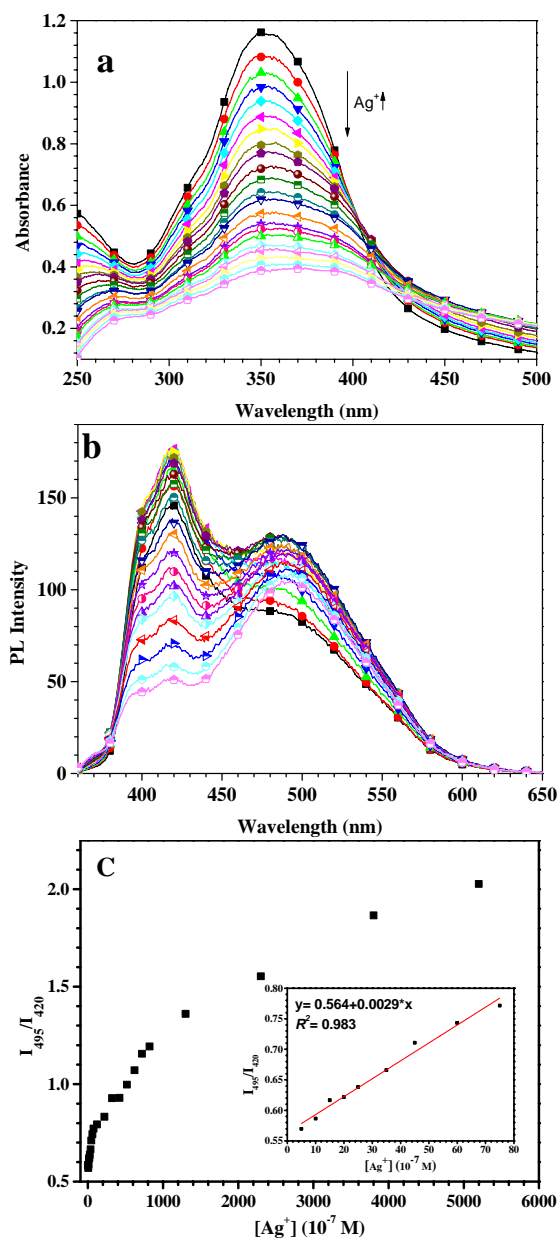


Fig. 4 UV-vis (a) and fluorescence (b) alterations of **P3** ($\sim 1.5 \times 10^{-5}$ M) in THF-water mixture ($V_{\text{THF}}/V_{\text{Water}}=4/1$) (buffered with Tris-CA, 1 mM, pH=7.4) ($\lambda_{\text{ex}}=350$ nm) in the presence of incremental Ag^+ (from 0 to 5.2×10^{-4} M), and corresponding relationship between I_{495}/I_{420} and Ag^+ (c) (inset is the fitting curve with concentration of Ag^+ lower than 8×10^{-6} M).

Furthermore, the interference of other common background metal ions to the detection of Ag^+ by **P3** was investigated in competing experiments and the results are displayed in **Fig. 5**. From it one can see that with the addition of Ag^+ , remarkable enhancement of I_{495}/I_{420} values was recorded for all of these background metal ions, suggesting that **P3** possesses good selectivity and anti-interference for Ag^+ .

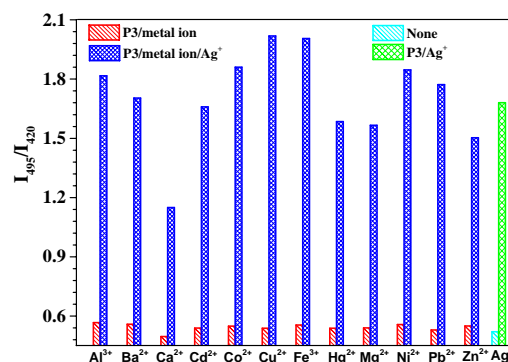


Fig. 5 I_{495}/I_{420} alterations with the sequential addition of background metal ions (5.0×10^{-5} M) and Ag^+ (5.0×10^{-5} M) in THF-water mixture ($V_{\text{THF}}/V_{\text{Water}}=4/1$) (buffered with Tris-CA, 1 mM, pH=7.4) ($\lambda_{\text{ex}}=350$ nm).

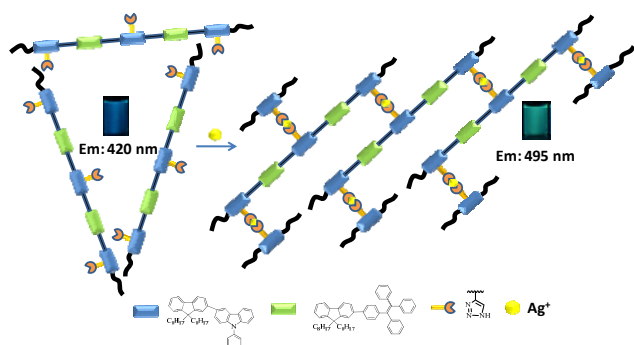
Plausible mechanism for Ag^+ probing

Above-mentioned discussion reveals that **P3** can act as an efficient fluorescence ratiometric probe for Ag^+ , here we will investigate further to get the insight about the mechanism of Ag^+ probing. Firstly, FT-IR spectra of **P3/Ag**⁺-adduct and **P3** are compared in **Fig. S4**. As compared to the corresponding spectrum of **P3**, the absorption signals located between $900\text{--}1200\text{ cm}^{-1}$ of **P3/Ag**⁺-adduct became intensified and broadened, indicating the presence of certain interrelation between **P3** and Ag^+ .

After that, we want to target the active segment, which plays the key role for the detection of Ag^+ , in the chemical structure of **P3**. Fluorescence response of precursor polymer, **P2**, toward Ag^+ , is thus investigated as a control experiment to find some traces. Distinct from the response behaviours observed for **P3**, under the fixed experimental condition, **P2** displayed insignificant fluorescence response to Ag^+ (**Fig. S5**). Given the same backbones and other alkyl attachments of these two polymers, the difference in Ag^+ -response of these two polymers might be related to the transformation of acetylene (in **P2**) groups to 1,2,3-triazoles (in **P3**).

In order to find more evidence for this speculation, other two control polymers with lower composition ratios of 1,2,3-triazoles in their structures relative to that of **P3**, referred to as **P3-1** and **P3-2**, were synthesized via the control of feed ratios between **P2** and azidotrimethylsilane. FT-IR spectra of **P3**, **P3-1** and **P3-2** are illustrated in **Fig. S6**. One can find from **Fig. S6** that the $\equiv\text{C-H}$ absorption signals at $\sim 3300\text{ cm}^{-1}$ decay from **P3-1** to **P3**, accompanied by the increase of absorption intensity at $\sim 3381\text{ cm}^{-1}$ (according to N-H stretching) and $\sim 1546\text{ cm}^{-1}$ (according to C=N stretching on 1,2,3-triazole), indicating the enhancement of 1,2,3-triazole composition ratios from **P3-1** to **P3**. Under the fixed experimental condition, fluorescence response of these three polymers to Ag^+ was investigated and the corresponding spectra are placed in **Fig. S7**. One can note from **Fig. S7** that I_{495}/I_{420} ratio values (with 1.87, 2.96 and 5.56 for **P3-1**, **P3-2** and **P3**, respectively) increase with the enhancement of 1,2,3-triazole composition ratios in polymers. This gives solid evidence that the 1,2,3-triazole in **P3** is responsible for the distinctive response of Ag^+ .

Based on these investigations, the plausible mechanism for Ag^+ probing by **P3** is depicted graphically in **Scheme 2**. According to previous literatures, the selective interaction between **P3** and Ag^+ might be due to the following reasons: 1) The specific affinity between weak Lewis acid (Ag^+) and the Lewis basic triazole rings;⁵⁵ 2) The strong coordination between Ag^+ and electron-rich triazole moieties,⁵⁶ and such complexation could induce the aggregation of polymer chains.⁵⁷ The AIEE effect of TPE segments took effect accordingly. The energy transfer exists from the high-energy fluorene-carbazole segments to relatively low-energy fluorene-TPE segments, and the emission turned from blue to green light accordingly.



Scheme 2 Proposed mechanism of Ag^+ probing by **P3**.

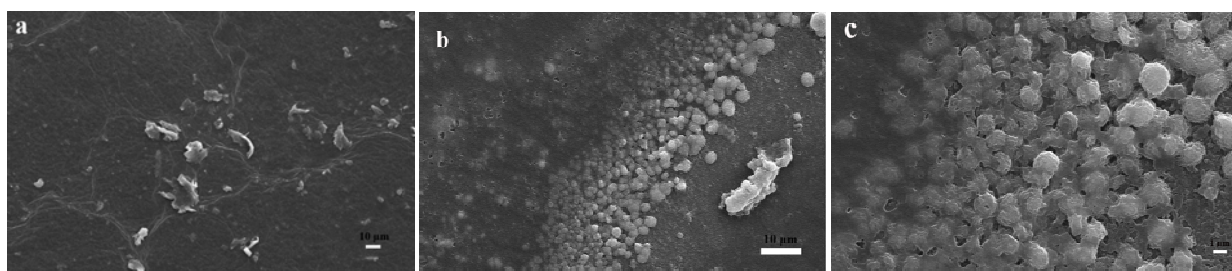


Fig. 6 SEM images of **P3** ($\sim 5.0 \times 10^{-5}$ M) before (a) and after (b, c) the addition of Ag^+ (2.5×10^{-4} M) (with THF-water mixture ($V_{\text{THF}}/V_{\text{water}}=4/1$) as dispersing medium for sample preparation).

Conclusions

In summary, we successfully synthesized a type of tetraphenylethene (TPE)-containing, *N*-unsubstituted-1,2,3-triazole-tethered conjugated polymer (**P3**). Photoluminescence investigation of **P3** in different composition ratio of THF-water mixing systems revealed that **P3** exhibited characteristics of dual-channel emission (at ~ 420 nm and ~ 495 nm) and aggregation-induced emission enhancement (AIEE). Owing to the presence of Ag^+ -coordinative segment, 1,2,3-triazole, in the structure of **P3**, the fluorescence of **P3** displayed distinct ratiometric alteration with the addition of Ag^+ , and the corresponding alteration in fluorescence is appreciable enough to be observed by naked eyes. The detection limit for Ag^+ reached $\sim 1.4 \mu\text{M}$ by **P3**, and the presence of other common metal ions brought insignificant interference for the Ag^+ detection by **P3**. Ag^+ -induced aggregation of polymer molecules, which was supported by the findings in scanning electron microscope (SEM) and dynamic light-scattering (DLS) studies, is the

plausible reason for the alteration of **P3**'s optical properties. The results reveal that **P3** can act as selective, sensitive and anti-interference fluorescence ratiometric probe for Ag^+ .

Acknowledgments

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Graphic Abstract

Selective fluorescence ratiometric detection of Ag^+ was achieved by *N*-unsubstituted-1,2,3-triazole decorated, aggregation-induced emission enhancement (AIEE) type conjugated polymer.

