Supporting Information

Effect of Polymer Ligand Structures on Fluorescence of Gold Clusters Prepared by Photoreduction

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Contents:

**SI-1:   The Characterization of Polymer Ligands.**

Gel Permeation Chromatography.   GPC was performed with an Agilent 1100 instrument using refractive index detector (RID) in order to obtain the molecular weights of polymer ligands. THF was used as the eluent at a flow rate of 1.0 mL/min at 23 $^{\circ}$C. The calculated molecular weights were based on a calibration curve for polystyrene standards of narrow polydispersity (Polymer Laboratories).
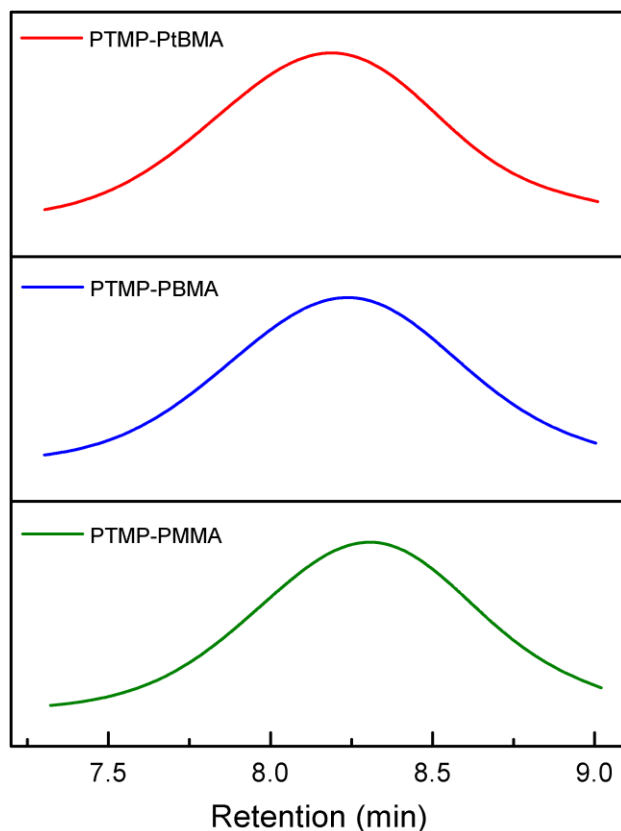
Fig. S1 GPC elution curves of polymer ligands PTMP-PMMA, PTMP-PBMA, and PTMP-PtBMA, respectively.

^{1}H NMR Spectroscopy.   ^{1}H NMR spectra were recorded in $CDCl_3$ on a Bruker AV400 MHz spectrometer at room temperature using the δ scale and tetramethylsilane (TMS) as an internal standard. The ^{1}H NMR spectra were similar to our previous works.[1]

PTMP-PMMA ($CDCl_3$) δ (ppm): 0.76-1.10 CH_3, 1.35-1.5 SH (from PTMP), 1.72-2.12 CH_2, 2.47-2.63 CH_2 (from PTMP), 2.63-2.78 CH_2 (from PTMP), 3.52-3.65 CH_3, 4.08-4.18 CH_2 (from PTMP)
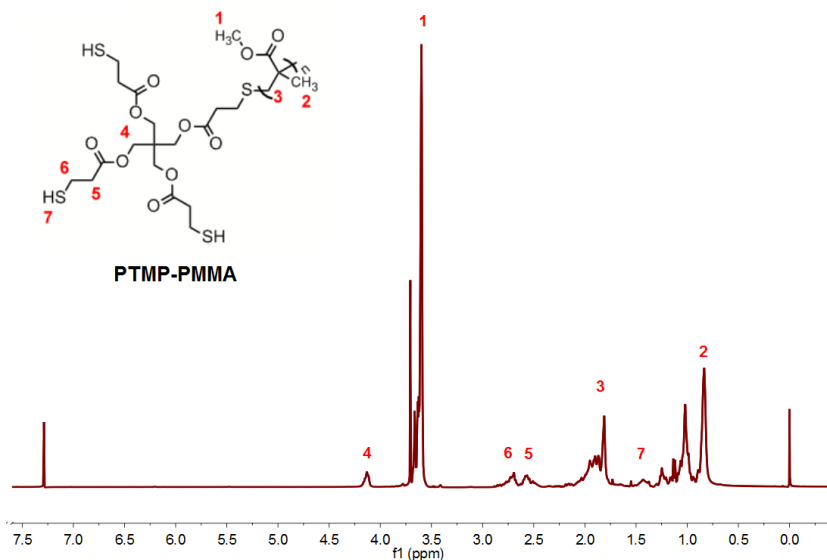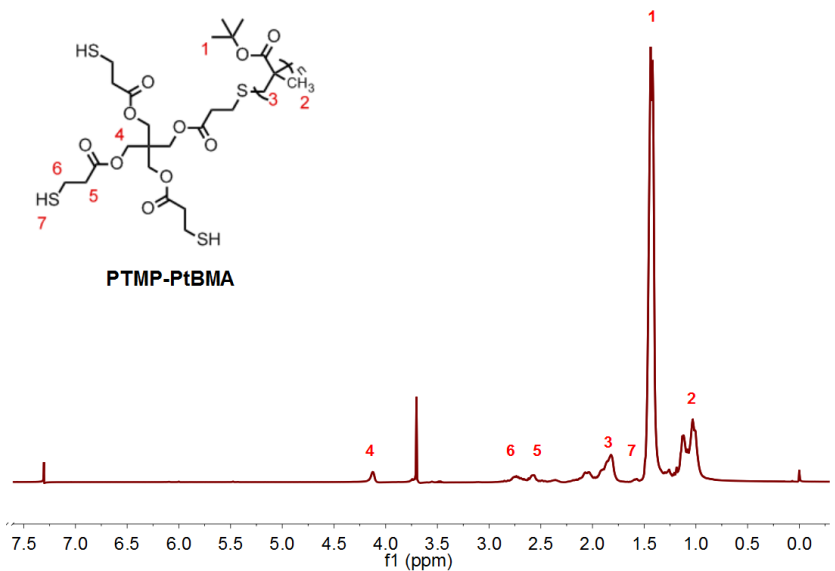
Fig. S2 ^{1}H NMR of polymer PTMP-PMMA

PTMP-PBMA (CDCl$_3$) δ (ppm): 0.8-1.08 CH$_3$, 1.31-1.50 CH$_2$, 1.51-1.70 CH$_2$, 1.72-2.12 CH$_2$, 2.47-2.63 CH$_2$ (from PTMP), 2.63-2.78 CH$_2$ (from PTMP), 3.52-3.65 CH$_3$, 3.84-4.06 CH$_2$, 4.08-4.18 CH$_2$ (from PTMP)
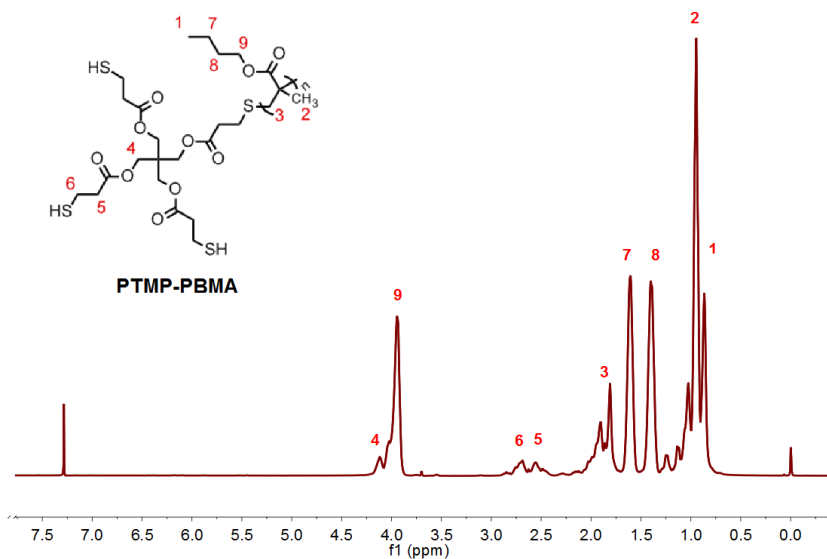
Fig. S3 ^{1}H NMR of polymer PTMP-PBMA

PTMP-PtBMA (CDCl$_3$) δ (ppm): 0.9-1.2 CH$_3$, 1.35-1.5 SH (from PTMP), 1.72-2.12 CH$_2$, 2.47-2.63 CH$_2$ (from PTMP), 2.63-2.78 CH$_2$ (from PTMP), 4.08-4.18 CH$_2$ (from PTMP)

Fig. S4 ^{1}H NMR of polymer PTMP-PtBMA

Table S1 Molecular weight and poly dispersity of PTMP-PMMA, PTMP-PBMA, and PTMP-PtBMA polymers measured by ^{1}H NMR and GPC method.

| Polymer Ligands	^{1}H NMR	GPC	
	Mn (g/mol)	*Mn* (g/mol)	*PDI*
PTMP-PMMA	4300	4000	1.88
PTMP-PBMA	5650	5100	1.74
PTMP-PtBMA	5800	5250	1.71
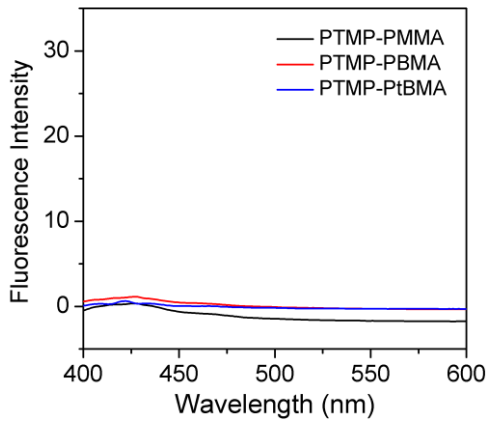
Fig. S5 Fluorescence emission spectra of polymer PTMP-PMMA, PTMP-PBMA, and PTMP-PtBMA, .

SI-2:   The Characterization of Au NCs
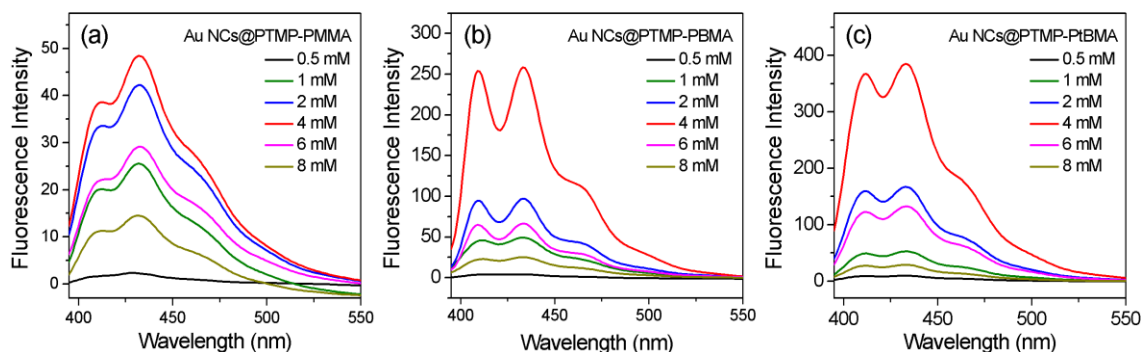
Fig. S6 Fluorescence emission spectra (excited at 375 nm) of Au NCs prepared by (a) PTMP-PMMA (b) PTMP-PBMA (c) PTMP-PtBMA at different ligands concentrations under equal irradiation condition.
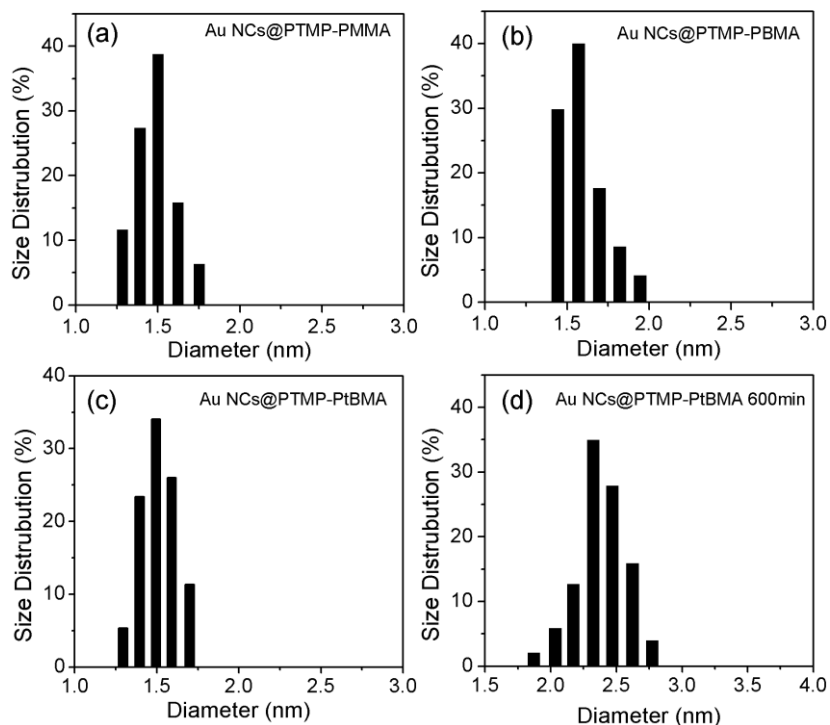

Fig. S7 Size distribution determined by DLS of (a) Au NCs@PTMP-PMMA, (b) Au NCs@PTMP-PBMA and (c) Au NCs@PTMP-PtBMA prepared under UV irradiation for 480 min. (d) DLS of Au NCs@PTMP-PtBMA prepared under UV irradiation for 600 min
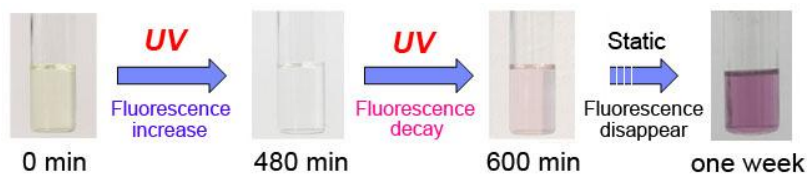
Fig. S8 Photograths of Au NCs@PTMP-PtBMA irradiated by UV light for different time and placed at room temperature for one week after 600 min irradiation, all of the images were taken under daylight.
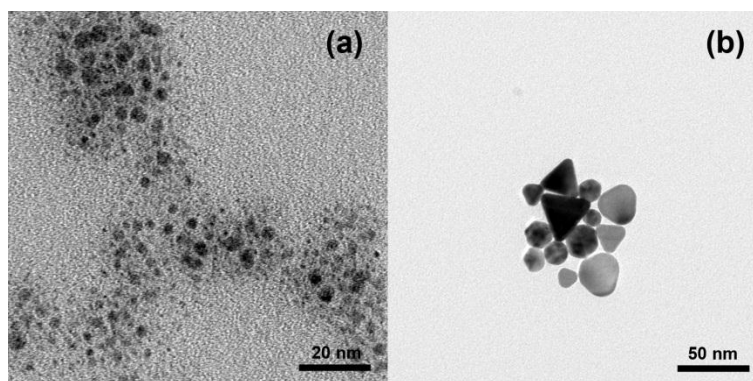
Fig. S9 TEM images of Au NCs@PTMP-PtBMA prepared under UV irradiation for (a) 600 min and (b) placed in room temperature for one week after 600 min irradiation.
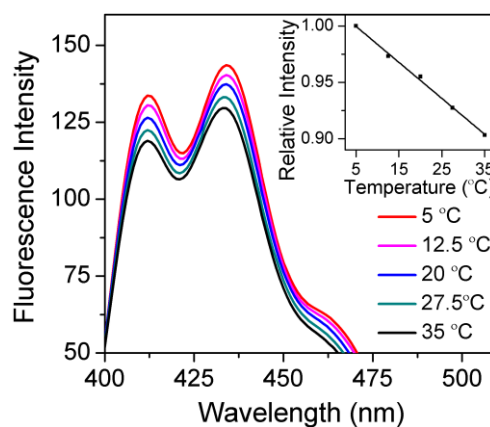
Fig. S10 Fluorescence emission spectra of Au NCs@PTMP-PtBMA at different temperature. The inset of (d) shows their relative intensities compared to the strongest emission.

SI-3:   References and Notes.

(1)   Huang, X.; Li, B.; Li, L.; Zhang, H.; Majeed, I.; Hussain, I.; Tan, B. *J. Phys. Chem. C* **2012**, *116*, 448.