

Supporting Information

Fluorescent Nanocomposites Based on Gold Nanoclusters for Metal Ion Detection and White Light Emitting Diode

Yongjie Zhang,^{a, b} Ning Feng,^a Shujin Zhou,^a Xia Xin^{a*}

^a *Key Laboratory of Colloid and Interface Chemistry, Ministry of Education, School of Chemistry and Chemical Engineering, Shandong University, Jinan, 250100, China*

^b *School of Chemical Engineering and Technology, Collaborative Innovation Center of Chemical Science and Chemical Engineering (Tianjin), Tianjin University, Tianjin, 300072, China*

*Author to whom correspondence should be addressed, E-mail: xinx@sdu.edu.cn

Phone: +86-531-88363597.

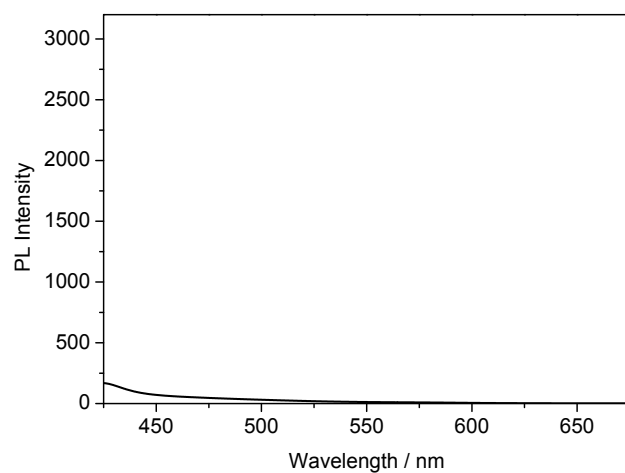


Figure S1. PL spectra of MPA-AuNCs solution.

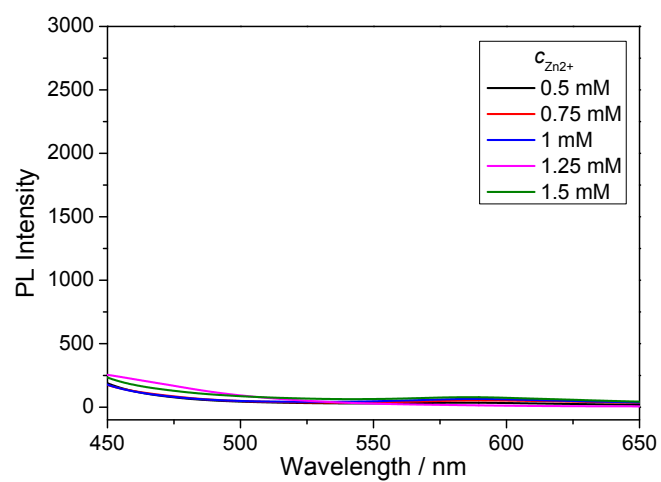


Figure S2. PL spectra of MPA-AuNCs solution with addition of different concentrations of Zn²⁺.



Figure S3. Photographs of the MPA-AuNCs under 365 nm UV light with addition of 2M-IM ($c_{2\text{M-IM}} = 6 \text{ mM}$) and different concentrations of Zn^{2+} (left to right: $c_{\text{Zn}^{2+}} = 3, 2.5, 2.25, 2, 1.75, 1.5, 1.25, 1, 0.5 \text{ mM}$).

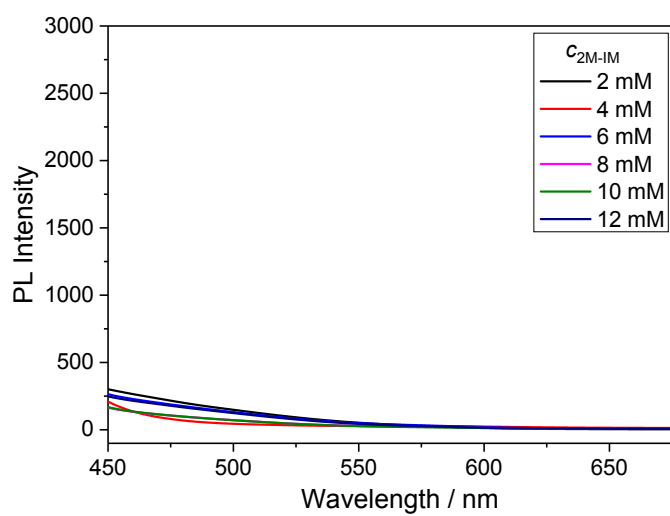


Figure S4. PL spectra of MPA-AuNCs solution with addition of different concentrations of 2M-IM.

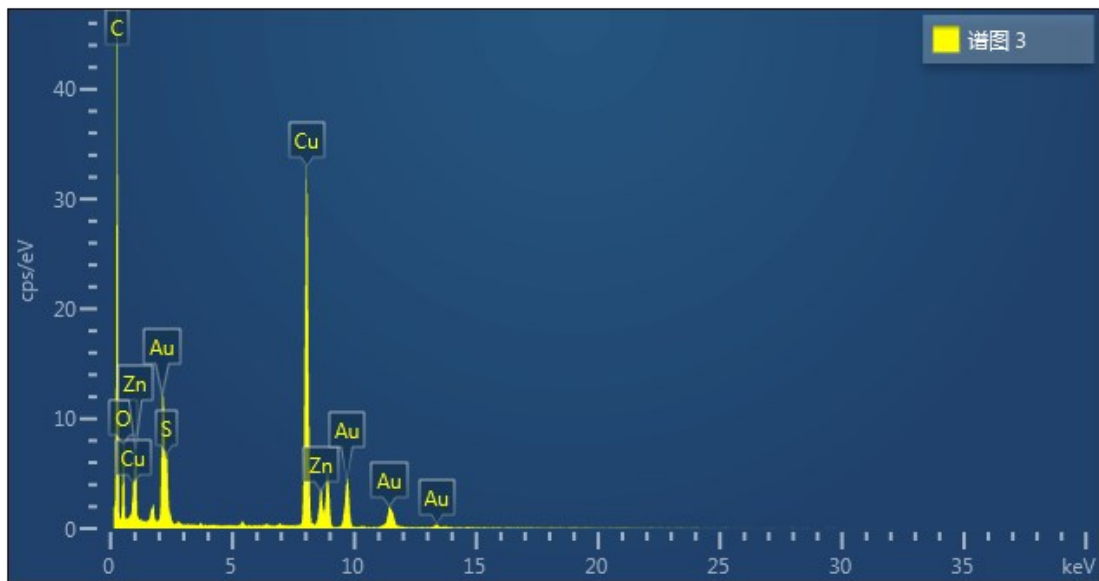


Figure S5. EDS of AuNCs@ZnS QDs.

Table S1. Elemental contents of AuNCs@ZnS QDs.

element	wt%	atomic %
C	41.73	77.20
O	4.97	6.91
S	2.65	1.83
Cu	32.22	11.27
Zn	3.14	1.07
Au	15.28	1.72
summary:	100.00	100.00

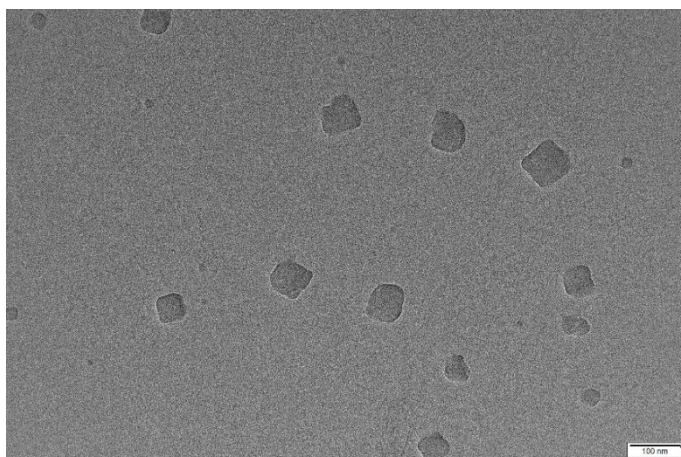


Figure S6. HR-TEM image of ZIF-8 ($c_{\text{Zn}^{2+}}=1$ mM, $c_{2\text{M-IM}}=6$ mM).

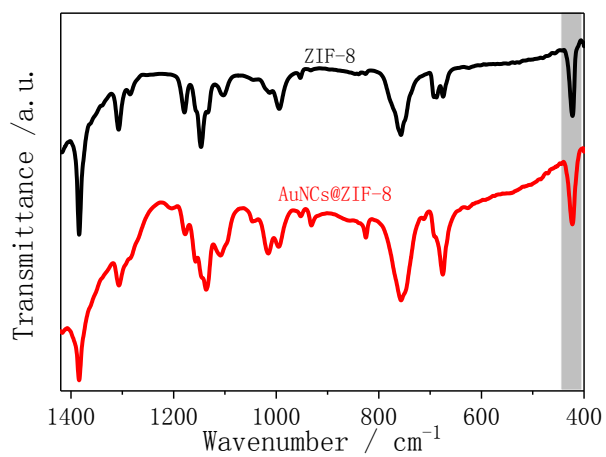


Figure S7. FT-IR spectra of ZIF-8 and AuNCs@ZIF-8.

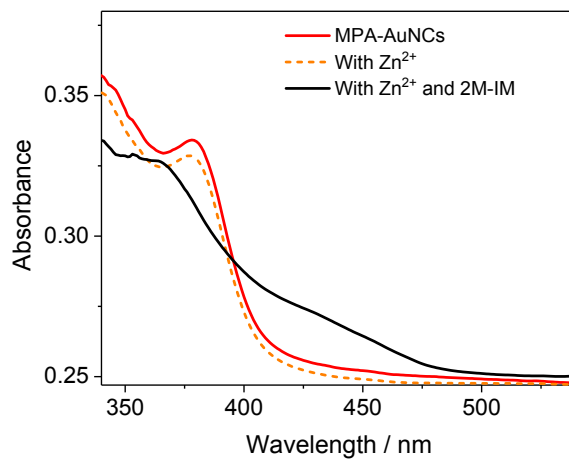


Figure S8. UV-vis absorption spectra of MPA-AuNCs and that with addition of Zn^{2+} . The black line displays the UV-vis spectrum of MPA-AuNCs instantly after addition of Zn^{2+} and 2M-IM.

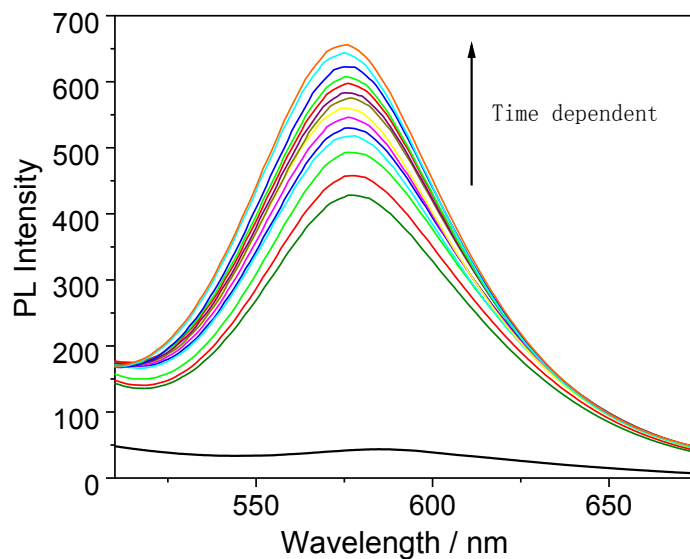


Figure S9. Time-dependent PL spectra ($\lambda_{\text{Ex}} = 365 \text{ nm}$) of MPA-AuNCs after addition of 1 mM Zn^{2+} and 6 mM 2M-IM .

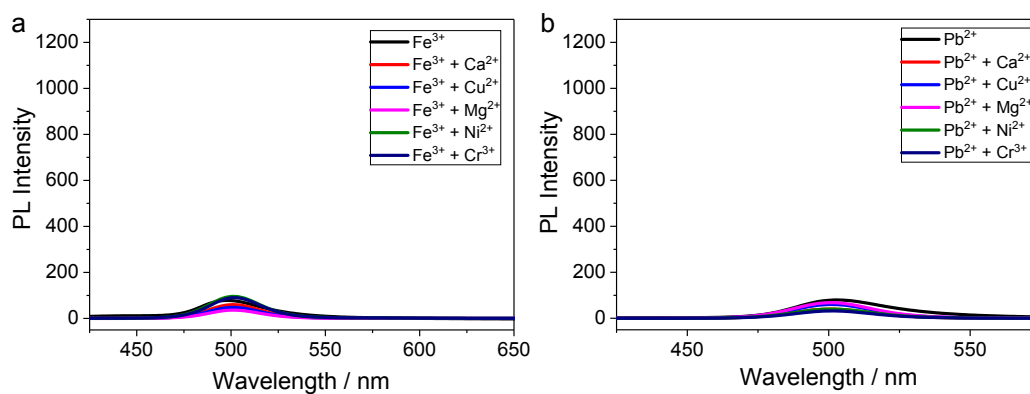


Figure S10. PL spectra ($\lambda_{\text{Ex}} = 365 \text{ nm}$) of AuNCs@ZnS QDs with addition of (a) Fe^{3+} ($150 \mu\text{M}$) and (b) Pb^{2+} ($150 \mu\text{M}$) in the presence of different other metal ions ($c = 150 \mu\text{M}$).

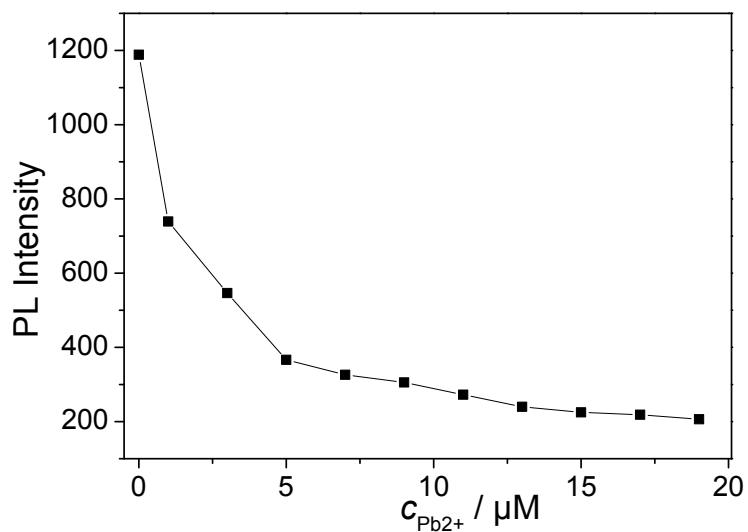


Figure S11. Change of PL intensity of AuNCs@ZnS with addition of increasing amount of Pb^{2+} .

Table S2. Limit of detection of AuNCs@ZnS for Fe^{3+} and Pb^{2+} in comparison with other previously reported fluorimetric chemical sensors

Limit of detection (μM)	Selectivity	reference
38	Fe^{3+}	1
19	Fe^{3+}	2
49	Fe^{3+}	3
24.8	Fe^{3+}	4
5.37	Fe^{3+}	This work
3.3	Pb^{2+}	5
0.8	Pb^{2+}	6
1.5	Pb^{2+}	7
0.25	Pb^{2+}	8
0.26	Pb^{2+}	This work

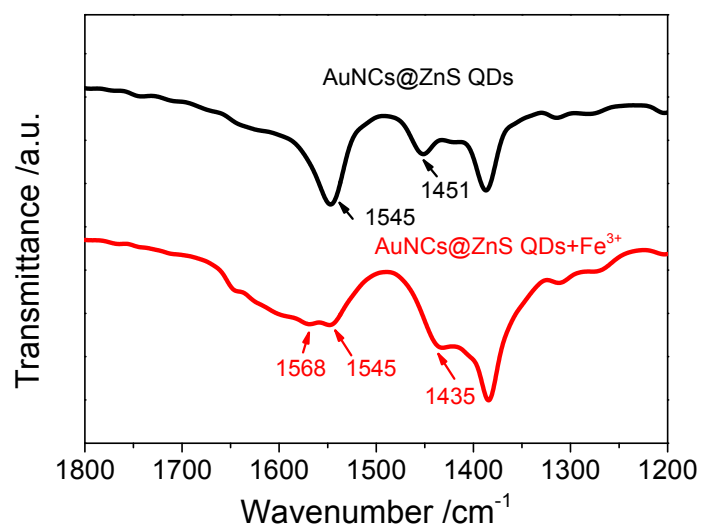


Figure S12. FT-IR spectra of AuNCs@ZnS QDs and AuNCs@ZnS QDs/Fe³⁺.

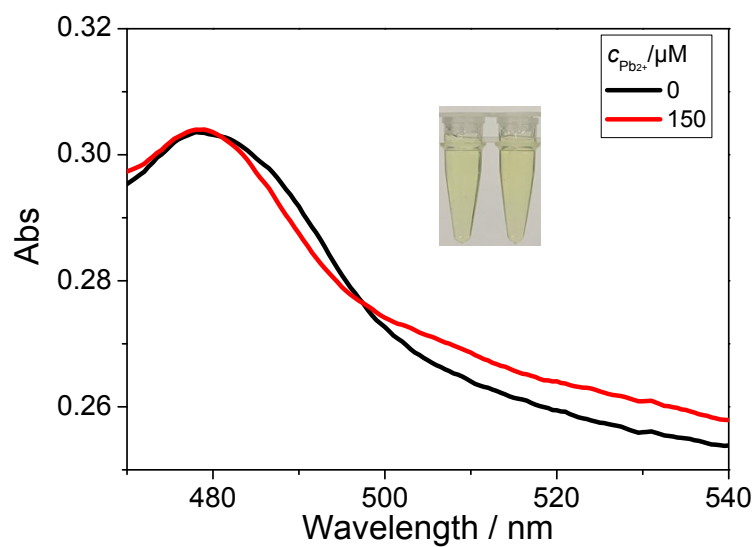


Figure S13. UV-vis absorption spectra of AuNCs@ZnS and that with addition of 150 μM Pb²⁺. Inset: photographs of AuNCs@ZnS (left) and that with addition of 150 μM Pb²⁺ (right).

References

- [1] Ma, TT, Zhao, X, Matsuo, Y, Song, J, Zhao, R, Faheem, M, Chen, M, Zhang, YF, Tian, YY, Zhu, GS. Fluorescein-based fluorescent porous aromatic framework for Fe^{3+} detection with high sensitivity, *J. Mater. Chem. C* 2019, 7, 2327-2332.
- [2] Bardhan, S, Roy, S, Chanda, D, Ghosh, S, Mondal, D, Das, S, Das, S. Nitrogenous carbon dot decorated natural microcline: an ameliorative dual fluorometric probe for Fe^{3+} and Cr^{6+} detection. *Dalton Trans.* 2020, 49, 10554-10566.
- [3] Yao, J, Liu, Y, Yang, L, Dou, A, Hou, C, Xu, Q, Huang, B, Zhu, A. Novel alkaline earth metal-organic frameworks with thiophene groups for selective detection of Fe^{3+} . *CrystEngComm*, 2020, 22, 5970-5979.
- [4] Shen, J, Wang, Z, Sun, D, Liu, G, Yuan, S. Mohamedally Kurmoob Xin, X. Self-assembly of water-soluble silver nanoclusters: superstructure formation and morphological evolution. *Nanoscale*, 2017, 9, 19191-19200.
- [5] Luan, W, Yang, H, Wan, Z, Yuan, B, Yu, X, Tu, S. Mercaptopropionic acid capped CdSe/ZnS quantum dots as fluorescence probe for lead (II). *J Nanopart Res* 2012, 14, 762.
- [6] Liu, T, Wan, X, Yao, Y. Dual sensitive and selective sensor for Pb^{2+} and Al^{3+} with distinctive fluorescence response. *Sensors and Actuators B* 2018, 254, 1094-1100.
- [7] Ma, L, Li, H, Wu, Y. A pyrene-containing fluorescent sensor with high selectivity for lead (II) ion in water with dual illustration of ground-state dimer. *Sensors and Actuators B* 2009, 143, 25-29.
- [8] M. L, Jiang, X, Wu, H, Lu, H, Li, H, Xu, H, Zang, S, Mak, T. Dual functional probe for “turn-on” fluorescence response of Pb^{2+} and colorimetric detection of Cu^{2+} based on a rhodamine derivative in aqueous media. *Dalton Trans.*, 2015, 44, 17326-17334.