

Supplementary Information for

A novel dual-emission fluorescent nanohybrid containing silica nanoparticles and gold nanoclusters for ratiometric determination of cysteine based on turn-on fluorescence strategy

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Figures and caption

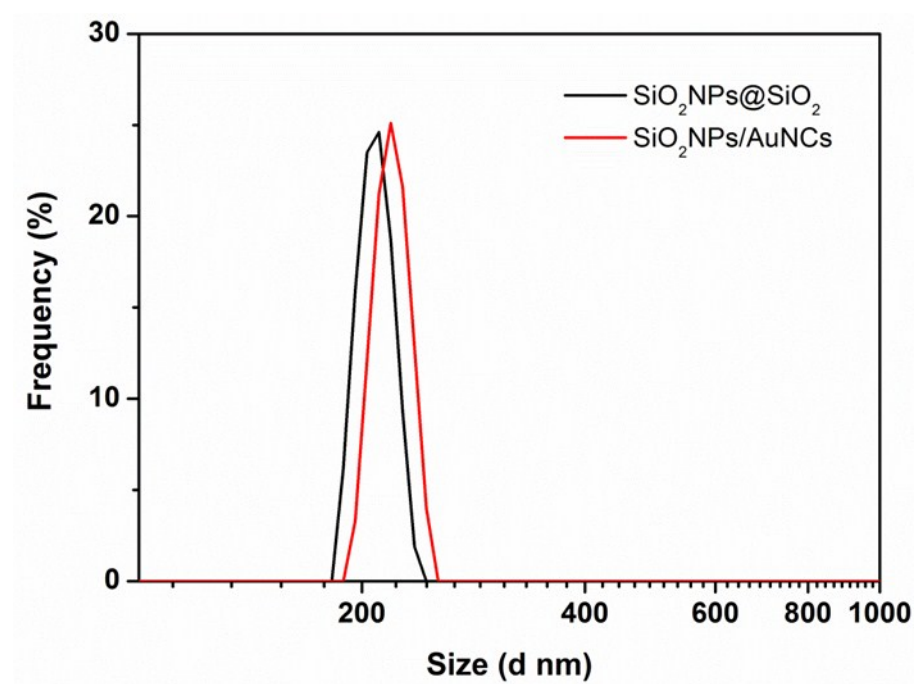


Fig. S1 Size distributions of SiNPs@SiO_2 and $\text{SiO}_2\text{NPs/AuNCs}$ nanohybrid.

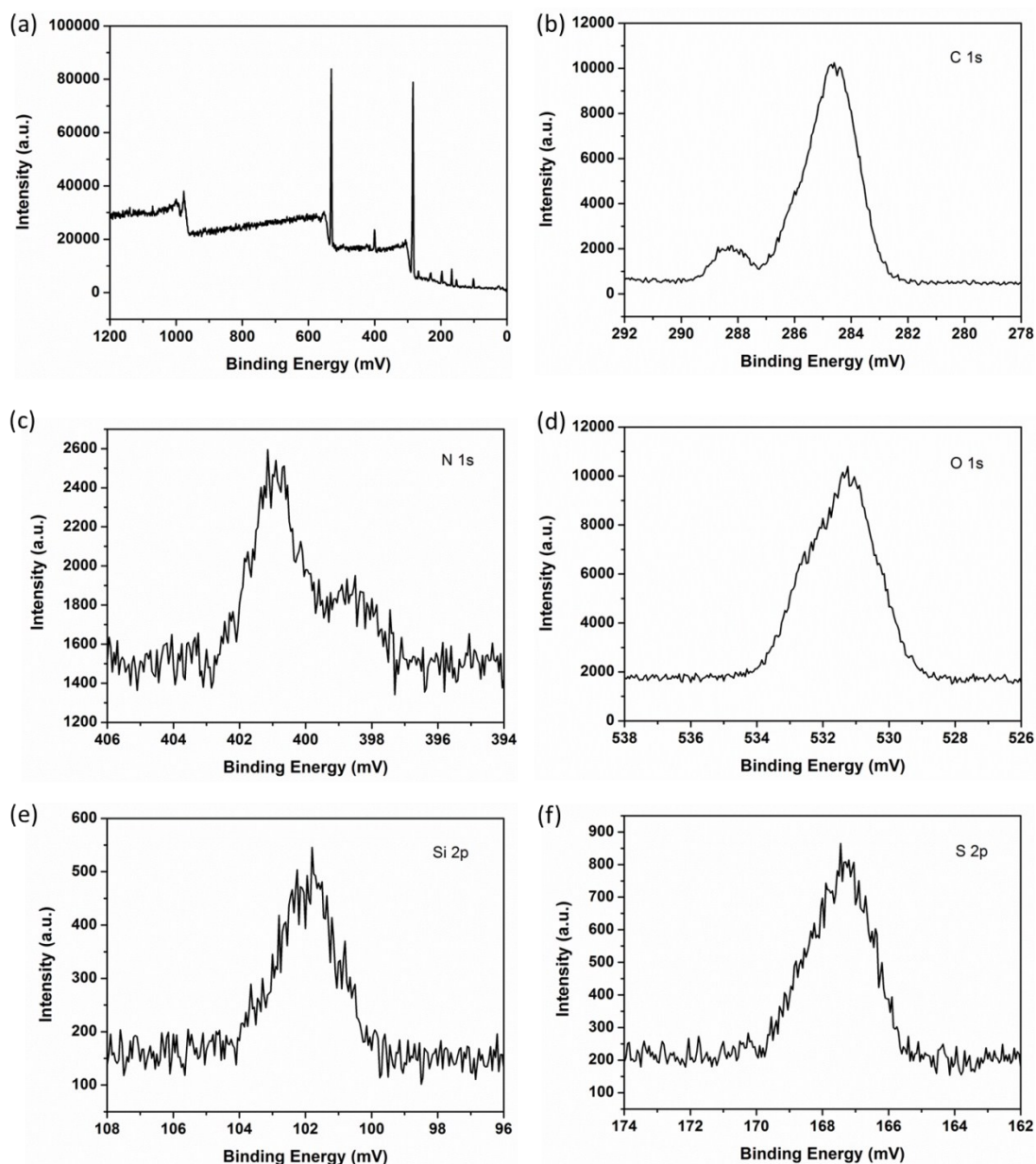


Fig. S2 (a) Wide scan XPS spectrum of the SiO₂NPs/AuNCs nanohybrid, and enlarge regions of (b) C 1s, (c) N 1s, (d) O 1s, (e) Si 2p and (f) S 2p XPS spectra.

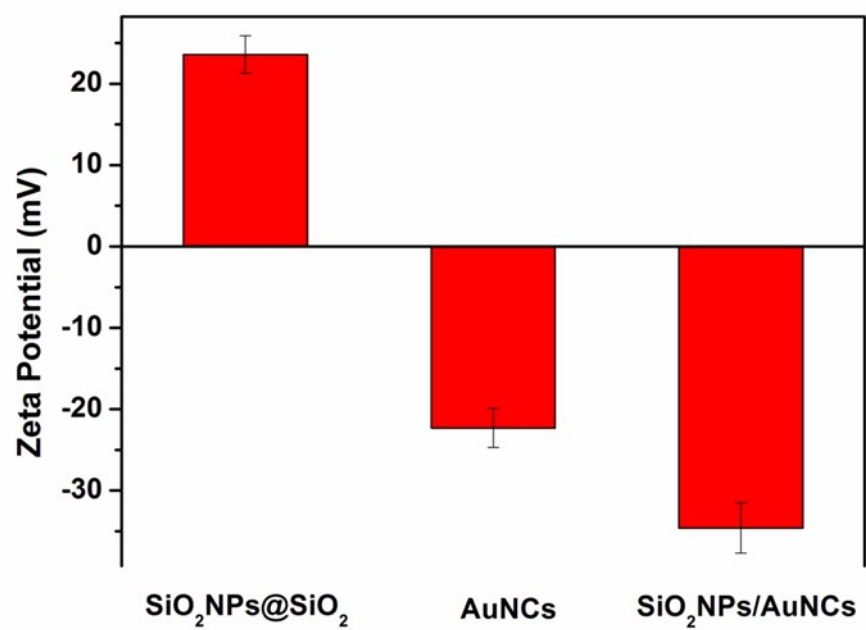


Fig. S3 Zeta potential of SiNPs@SiO_2 , GSH-AuNCs and $\text{SiO}_2\text{NPs/AuNCs}$ nanohybrid in aqueous solution.

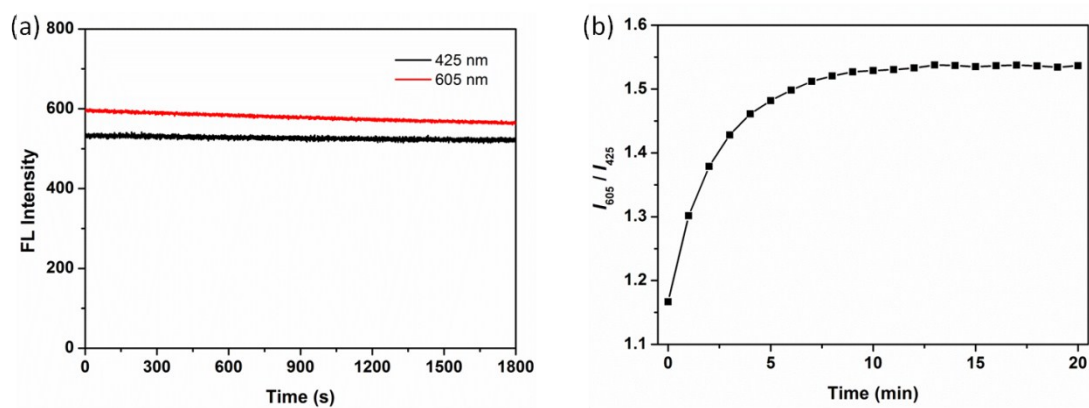


Fig. S4 (a) Fluorescence stability test of SiO₂NPs/AuNCs nanohybrid under long-term UV illumination (360 nm). (b) The time-dependent fluorescence intensity ratio (I_{605}/I_{425}) change of SiO₂NPs/AuNCs nanohybrid (1mg/mL) in presence of 100 μ M Cys.

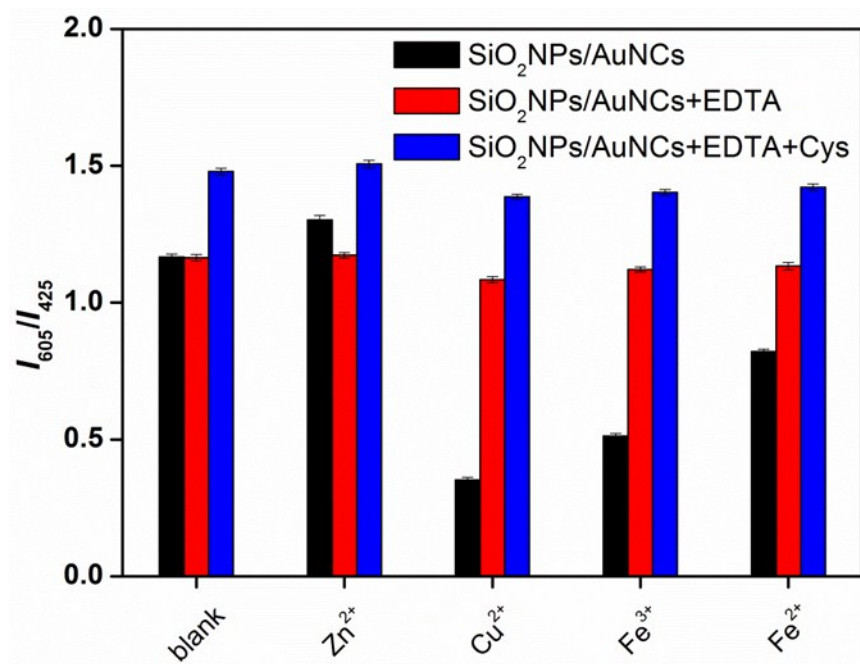


Fig. S5 Fluorescence intensity of probe (SiO₂NPs/AuNCs nanohybrid) in the absence and presence of 50 μ M ions (black bars), subsequent addition of 1 mM EDTA (red bars) and final addition of 50 μ M Cys (blue bars) to the mixture.

Table S1 Research papers available up to now concerning different fluorescence nanosensors for detection of Cys.

Ref.	materials	Linear range	LOD	response strategy
S1	Hb-FeQCs-Zn ²⁺	1-60 μ M	0.25 μ M	Turn-on (I_{567})
S2	GSH-Au/AgNCs	0.05-10 μ M 10-50 μ M	2.5 nM	ratiometric (I_{616}/I_{412})
S3	N-S-CDs-Hg ²⁺	5-50 μ M	0.4 μ M	Turn-on (I_{490})
S4	rGO/Au	--	0.51 nM	Turn-on (I_{447})
S5	NCNDs-Hg ²⁺	1-10 μ M	40 nM	Turn-on (I_{444})
S6	AuNCs /CQDs	0-60 μ M	0.1 μ M	ratiometric (I_{605}/I_{465})
S7	AuNCs-Ag ⁺	0-2.71 μ M	16.54 nM	Turn-off (I_{610})
S8	S,N-CQDs- Ag ⁺	0-10 μ M 10-120 μ M	0.35 μ M	Turn-on (I_{424})
This work	SiNPs/AuNCs	0-20 μ M	0.35 μ M	ratiometric (I_{605}/I_{425})

References in ESI

- [S1] N. Hashemi, Z. Vaezi, M. Sedghi, H. Naderi-Manesh, Hemoglobin-incorporated iron quantum clusters as a novel fluorometric and colorimetric probe for sensing and cellular imaging of Zn(II) and cysteine, *Microchimica Acta*, 185 (2017) 60.
- [S2] M. Liu, N. Li, Y. He, Y. Ge, G. Song, Dually emitting gold-silver nanoclusters as viable ratiometric fluorescent probes for cysteine and arginine, *Microchimica Acta*, 185 (2018) 147.
- [S3] R. Tabaraki, O. Abdi, Green and simple turn off/on fluorescence sensor for mercury (II), cysteine and histidine, *Journal of Molecular Liquids*, 251 (2018) 77-82.
- [S4] B. Thirumalraj, N. Dhenadhayalan, S.-M. Chen, Y.-J. Liu, T.-W. Chen, P.-H. Liang, K.-C. Lin, Highly sensitive fluorogenic sensing of L-Cysteine in live cells using gelatin-stabilized gold nanoparticles decorated graphene nanosheets, *Sensors and Actuators B: Chemical*, 259 (2018) 339-346.
- [S5] S.S.J. Xavier, G. Siva, J. Annaraj, A.R. Kim, D.J. Yoo, G.G. kumar, Sensitive and selective turn-off-on fluorescence detection of Hg^{2+} and cysteine using nitrogen doped carbon nanodots derived from citron and urine, *Sensors and Actuators B: Chemical*, 259 (2018) 1133-1143.
- [S6] X. Yu, C.-X. Zhang, L. Zhang, Y.-R. Xue, H.-W. Li, Y. Wu, The construction of a FRET assembly by using gold nanoclusters and carbon dots and their application as a ratiometric probe for cysteine detection, *Sensors and Actuators B: Chemical*, 263 (2018) 327-335.

- [S7] Y. Li, Y. Deng, X. Zhou, J. Hu, A label-free turn-on-off fluorescent sensor for the sensitive detection of cysteine via blocking the Ag⁺-enhancing glutathione-capped gold nanoclusters, *Talanta*, 179 (2018) 742-752.
- [S8] S. Liao, X. Zhao, F. Zhu, M. Chen, Z. Wu, X. song, H. Yang, X. Chen, Novel S, N-doped carbon quantum dot-based "off-on" fluorescent sensor for silver ion and cysteine, *Talanta*, 180 (2018) 300-308.