Supplementary Materials

Novel approach to photoelectrochemical immunoassay for procalcitonin on the basis of SnS_2/CdS

Mengdi Wang, Xuejing Liu, Hongying Jia, Yuyang Li, Xing Ren, Dan Wu, Huan Wang, Qin Wei*, Huangxian Ju

Key Laboratory of Interfacial Reaction & Sensing Analysis in Universities of Shandong, School of Chemistry and Chemical Engineering, University of Jinan, Jinan 250022, PR China

***Corresponding author**

E-mail: sdjndxwq@163.com (Q. Wei)

Tel: +86 531 82767872;

Fax: +86 531 82767367

Materials and reagents

Tin (IV) chloride pentahydrate ($SnCl_4 \cdot 5H_2O$) was purchased from Macklin Biochemical Co., Ltd (Shanghai, China). Cadmium acetate ($C_4H_6CdO_4 \cdot 2H_2O$) was obtained from Shanghai Runjie Chemical Reagent Co., Ltd. Thiocarbamide ($(NH_2)_2CS$) was obtained from Beijing Chemical Plant. Thioglycolic acid (TGA) was obtained from Tianjin Kermel Chemical Reagent Co., Ltd. 1-ethyl-3-(3-dimethylaminopropyl) carbodiimide hydrochloride (EDC) and N-hydroxysuccinimide (NHs) were obtained from Shanghai Civic Chemical Technology Co., Ltd. Bovine serum albumin (BSA) was obtained from Aladdin Reagent Co., Ltd. (Shanghai, China). Serum procalcitonin (PCT) and anti-procalcitonin (anti-PCT) were all purchased from Nanjing Kingsrui Biotechnology Co., Ltd. Phosphate buffer solution (PBS) which was prepared by disodium hydrogen phosphate ($Na_2HPO_4 \cdot 12H_2O$, 0.1 mol/L) and potassium phosphate monobasic (KH_2PO_4, 0.1 mol/L). All other chemicals were analytical grade and used without further purification. All aqueous solutions were prepared using ultra-pure water.

Apparatus

The experiments carried out in a DZF-6020 vacuum drier (Shanghai boxun industrial co. LTD. Medical equipment factory). The photocurrent and electrochemical impedance spectroscopy (EIS) were detected on an IM6-Zennium electrochemical workstation (Zahner, Germany). X-ray diffraction (XRD) patterns were measured using D8 focus diffractometer (Bruker AXS, Germany). XPS

spectrums were acquired on ESCALAB 250XI (Thermo, America). High-resolution transmission electron microscope (HRTEM) images were obtained on an H-800 transmission electron microscope (Hitachi, Japan). A conventional three electrodes system, which contains a Pt wire counter electrode, a potassium chloride (KCl) saturated calomel reference electrode and an ITO conductive glass (Zhuhai kaiwei electronic components Co., Ltd.) working electrode, was used in the measurement of photocurrent.

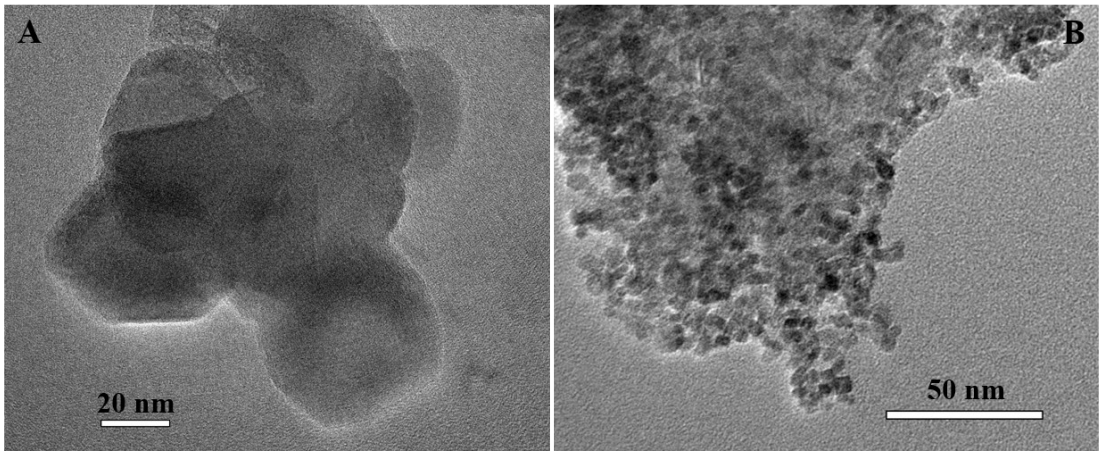
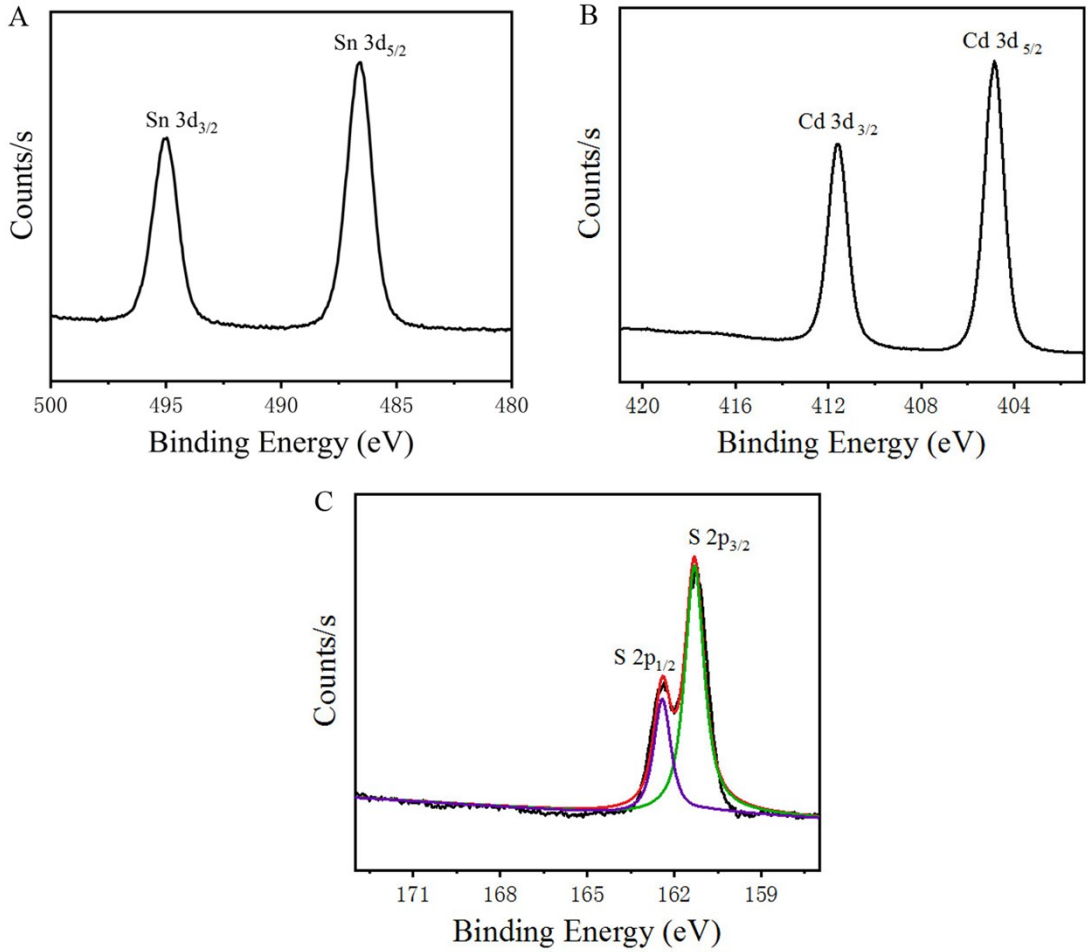


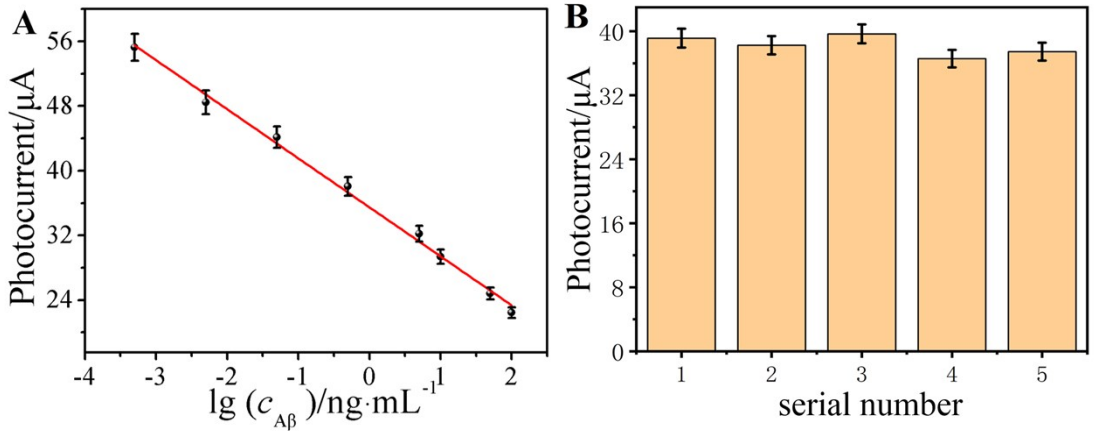
Fig. S1 HRTEM images of (A) SnS_2, (B) CdS.



53

54 Fig. S2 XPS patterns of the as-prepared SnS_2/CdS: (A) Sn 3d, (B) Cd 3d, (C) S 2p.

55



56

57 Fig. S3 (A) Calibration curves for immunoassay after modification of PCT at different

58 concentrations ($\Delta I = 35.39 - 5.93 \lg c$, $R^2 = 0.9953$). (B) Reproducibility of the PEC immunoassay.

Table S1. Comparison with other published immunosensor for the analysis of PCT.

Method	Linear range (ng mL^{-1})	Detection limit (pg mL^{-1})	Reference
Fluorescence	0.1-3	20	1
Lateral Flow Immunoassay	0.5-10	100	2
Imaging llipsometry	0.125-128	81	3
Electrochemiluminescence	0.00005-10	0.017	4
Sandwich-type Electrochemical sensor	0.05-100	0.1	5
This work	0.0005-100	0.17	This work

Table S2. PCT anaylsis in human serum fluid sample by prepared PEC immunoassay ayatem

Initial PCT in the sample (ng/mL)	Added amounts (ng/mL)	Detection amounts (ng/mL)	RSD (%)	Recovery (%)
0.68	0.30	1.02，0.03，0.95，0.96，0.99	3.2	101
	0.60	1.34，1.33，1.31，1.27，1.29	2.8	102
	1.00	1.75，1.71，1.64，1.65，1.67	4.1	100

References

1. D. Rascher, A. Geerlof, E. Kremmer, P. Krämer, M. Schmid, A. Hartmann and M. Rieger, Biosens. Bioelectron., 2014, 59, 251-258.
2. K. V. Serebrennikova, J. V. Samsonova, A. P. Osipov, D. Senapati and D. V. Kuznetsov, Nano Hybrids and Composites, 2017, 13, 47-53.
3. Y. Li, W. Liu, G. Jin, Y. Niu, Y. Chen and M. Xie, Anal Chem, 2018, 90, 8002-8010.
4. P. Chen, X. Qiao, J. Liu, F. Xia, T. Dong and C. Zhou, Sensor. Actuat. B-Chem., 2018.
5. P. Liu, C. Li, R. Zhang, Q. Tang, J. Wei, Y. Lu and P. Shen, Biosens. Bioelectron., 2019, 126, 543-550.