Electronic Supplementary Information

A sensitive electrochemiluminescence immunosensor for carbohydrate antigen 12-5 analysis based on a dual-function SnO_2 nanoflowers

Xiangfei Zheng, Dongmiao Qin, Guichun Mo, Weiming Mo and Biyang Deng*

State Key Laboratory for Chemistry and Molecular Engineering of Medicinal Resources, School of Chemistry and Pharmaceutical Sciences, Guangxi Normal University, Guilin 541004, China

*Corresponding Author:

Email: dengby16@163.com

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1. X-ray photoelectron spectroscopies of SnO_2NFs

XPS characterization is used to determine the element composition and chemical oxidation valence of SnO_2NFs. The binding energies obtained in the XPS analysis were corrected for specimen charging by referencing the C1s line to 284.6 eV. The result of the wide survey scan shown in Fig.S1A learly reveals that the existence of Sn and O elements. The Sn3d spectrum showed that centered around 495.1 eV and 486.7 eV spin orbit of twin peaks (Fig.S1B), corresponding to $Sn3d_{3/2}$ and $Sn3d_{5/2}$, respectively, indicating that Sn^{4+} in SnO_2 is in a normal oxidation valence, which consistent with the reported on the SnO_2 structure.[1,2] As shown in Fig.S1C, the O1s spectrum showed the binding energies of 530.7 eV could be the lattice oxygen of SnO_2.[3]

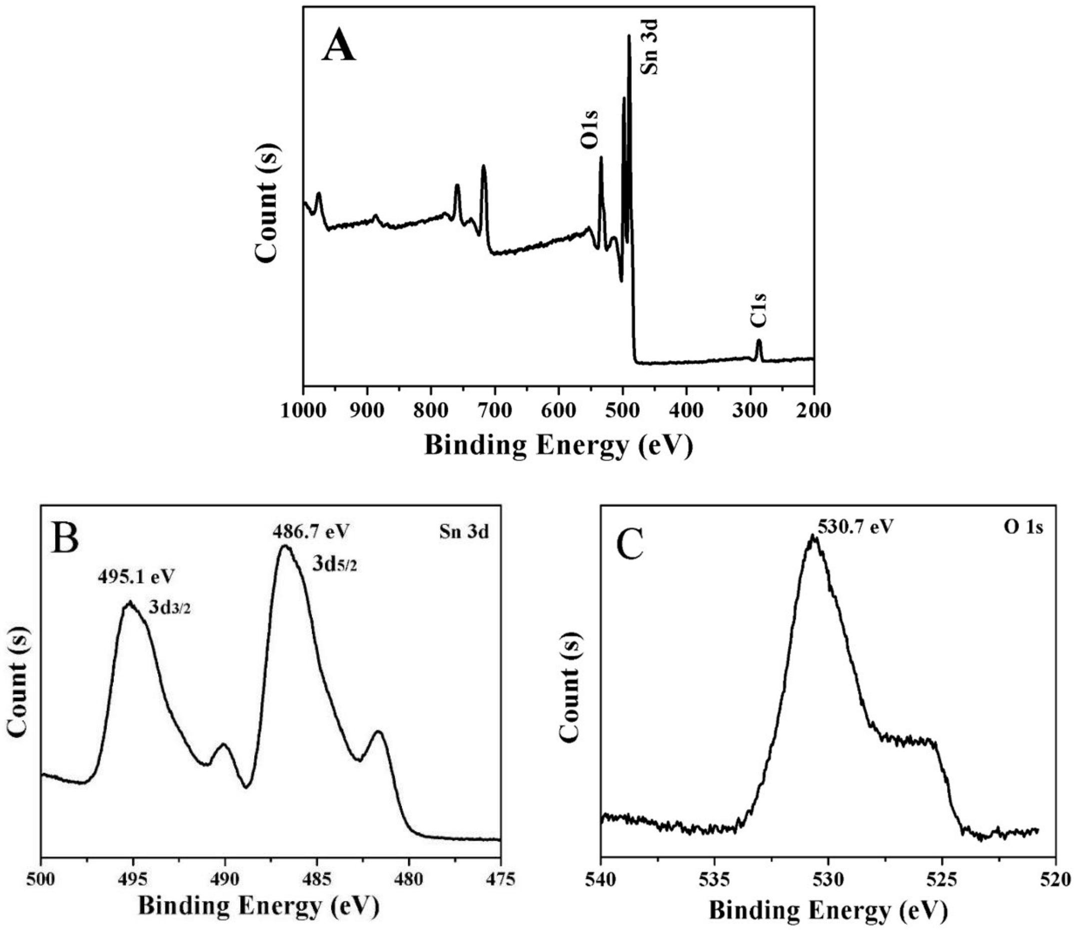

Fig. S1. XPS scans of SnO_2NFs：Survey spectrum (A), Sn3d spectrum (B) and O1s spectrum (C).

2. UV-vis spectra and XRD pattern of the prepared materials

The SnO_2NFs, PEI-SnO_2NFs, AuNPs and AuNPs/PEI-SnO_2NFs composites were investigated by UV-vis. As shown in Fig.S2A, SnO_2NFs presented a characteristic peak at 325 nm (curve a). Compared with SnO_2NFs, the absorption peak of PEI-SnO_2NFs was red shifted to 337 nm (curve b). PVP-AuNPs showed a main peak at 538 nm and a shoulder peak at 620 nm (curve c). The AuNPs/PEI - SnO_2NFs composite (curve d) showed the same absorption wavelength range both PEI-SnO_2NFs and PVP-AuNPs, indicating the successful preparation of AuNPs/PEI-SnO_2NFs composites. Fig.S2B presented the XRD patterns of AuNPs (curve a), SnO_2NFs (curve b) and AuNPs/PEI-SnO_2NFs (curve c). It is observed from that the 2θ of SnO_2NFs diffraction peaks are 26°, 34°, 37°, 52° and 61°, corresponding to (110), (101), (200), (211) and (310) crystal surfaces, respectively. The crystal plane shows good crystallinity.[4] It can found that the XRD peaks of AuNPs/PEI-SnO_2NFs were completely coincided with SnO_2NFs and AuNPs, the diffraction peaks of AuNPs in 38.2° (111), 44.3° (200), 64.6° (220), 77.3° (311), respectively.[5] It can be concluded that the AuNPs was successfully fixed on the surface of SnO_2NFs.

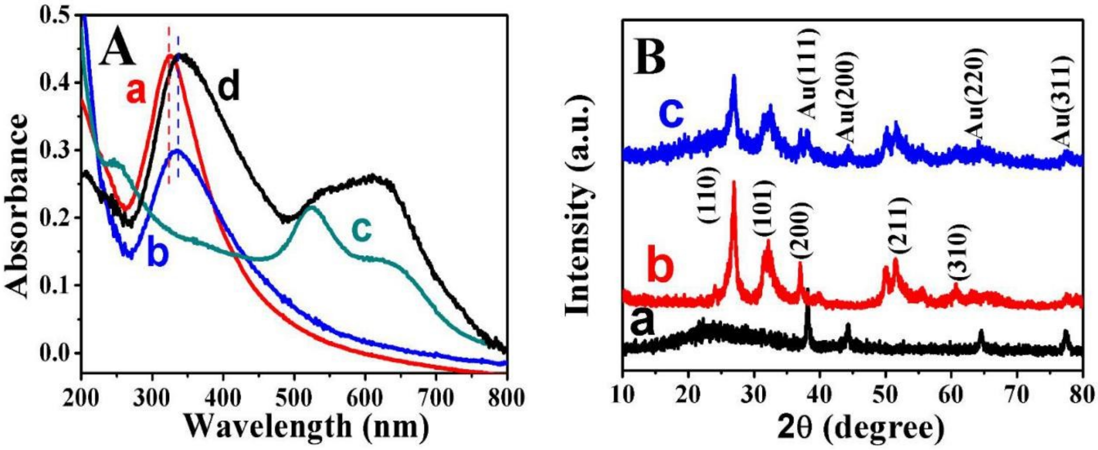

Fig. S2. (A) UV-vis optical spectra of SnO_2NFs (a), PEI-SnO_2NFs (b), AuNPs (c) and AuNPs/PEI-SnO_2NFs (d); (B) XRD patterns of AuNPs (a)，SnO_2NFs (b) and AuNPs/PEI-SnO_2NFs (c).

3. EDS spectra of AuNPs/PEI-SnO_2NFs and Ag@ZnONSs

The elemental analysis of the AuNPs/PEI-SnO_2NFs and Ag@ZnONSs composite was further studied by EDS spectra. As shown in Fig.S3A, AuNPs/PEI-SnO_2NFs composite mainly contains three elements of 73.56% Sn, 23.55% O and 2.89% Au, indicating that the AuNPs were grown on the surface of SnO_2NFs successfully. It could be observed from Fig.S3B that the major elements of Ag@ZnONSs composite were 25.88% Zn, 14.21% O and 59.91% Ag, indicating that the AgNPs were reduced to the surface of ZnONSs successfully.

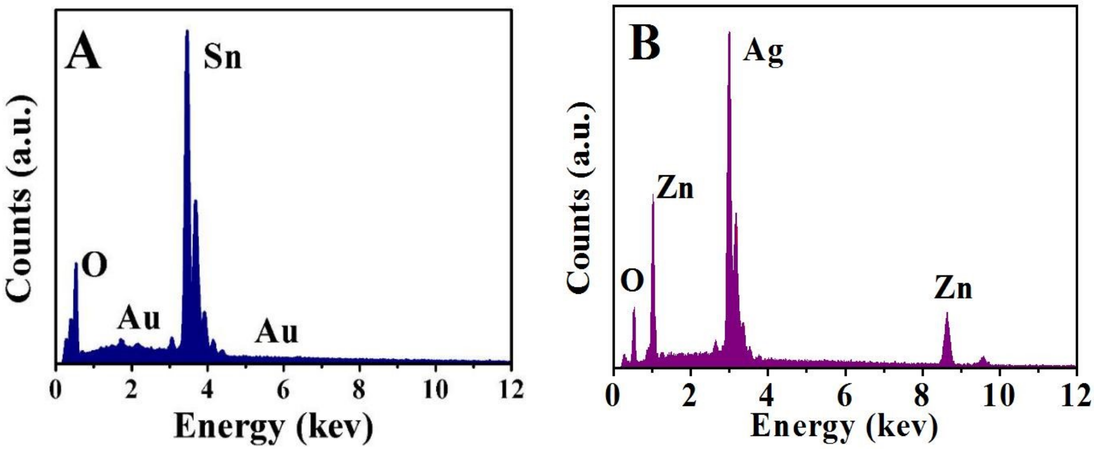

Fig. S3. EDS diagrams of AuNPs/PEI-SnO_2NFs (A) and Ag@ZnONSs (B).

References

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