Supporting Information

Enzyme activity-modulated etching of gold nanobipyramids@MnO_2 nanoparticles for ALP assay with surface-enhanced Raman spectroscopy

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1. Calculation of SERS enhancement factor

The enhancement factor is calculated by the formula:

$$Enhancement\ factor = \frac{I_{SERS} \times C_{dis}}{I_{Raman} \times C_{ad} \times f_{sh}}.$$

I_{SERS} and I_{Raman} represent the Raman intensity of the Au NBPs+CV system and CV solution at the 1618 cm^{-1}, respectively. C_{dis} and C_{ad} are the CV concentrations in solution and adsorbed on the surface of nanoparticles, respectively. The factor f_{sh} takes into account the shielding of exciting and scattered light by colloidal particles. We have adopted a value of 0.25 for this factor. [S1] Raman measurements were carried out under the same experimental conditions including laser power, laser wavelength, and objective, etc..

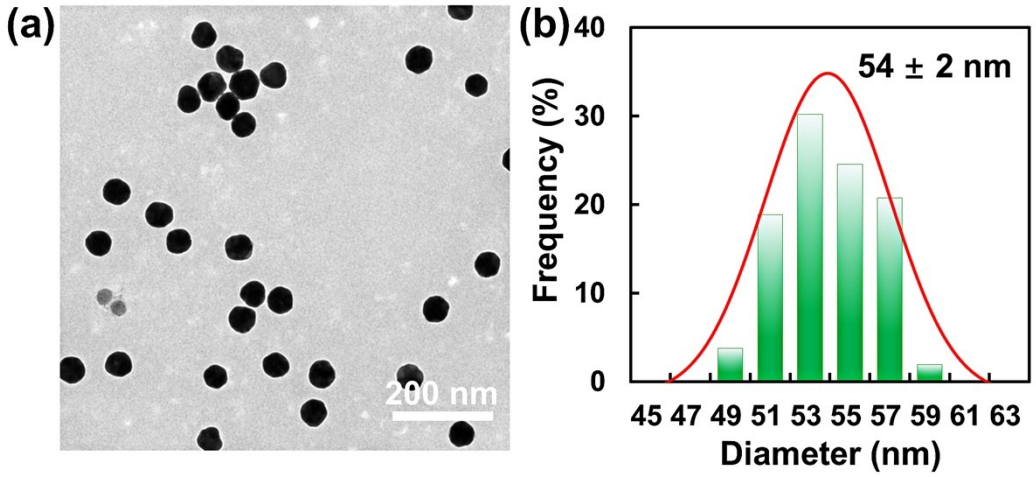

Fig. S1 (a) TEM image and (b) particle size statistics of Au NPs.

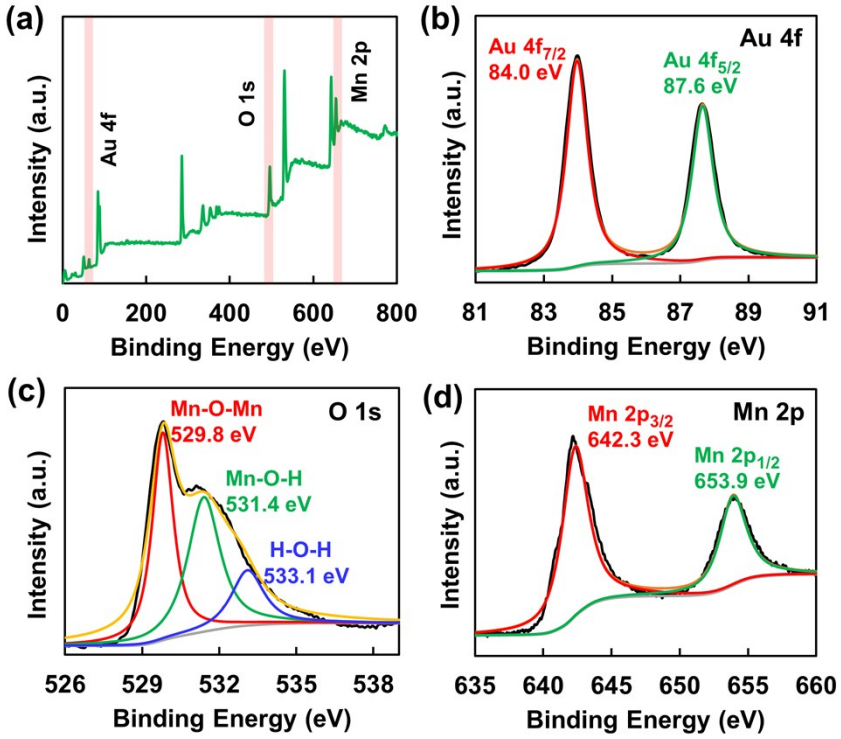

Fig. S2 XPS analysis of AMNS. (A) The entire XPS spectrum of AMNS. (B) Au 4f spectrum. (C) O 1s spectrum. (D) Mn 2p spectrum.

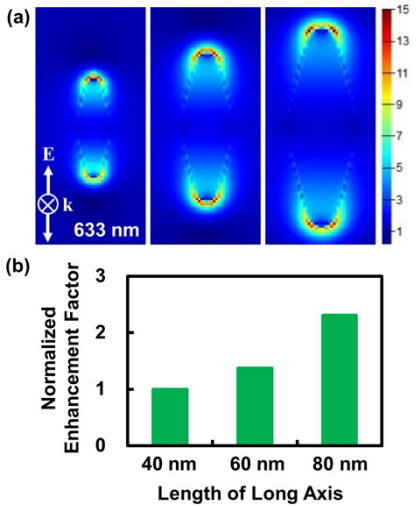

Fig. S3 (a) Simulated electric field distribution of Au NBPs with different sizes. (b) The normalized enhancement factor of Au NBPs with different sizes.

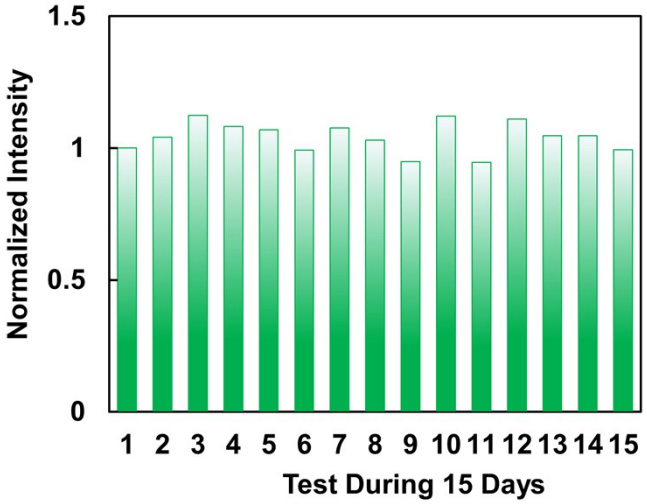

Fig. S4 Stability assay of AMNS by 15 Raman measurements over 15 days period.

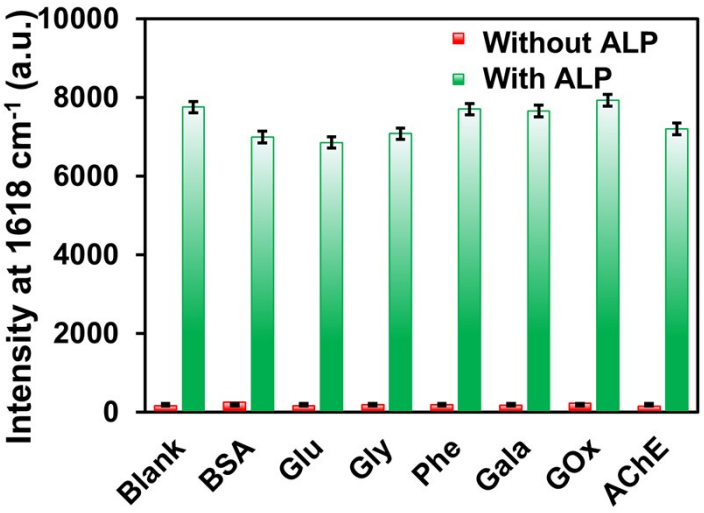

Fig. S5 Selectivity assay for ALP detection.

Table S1. Comparison of different methods for ALP detection.

Methods	Linear range (mU/mL)	LOD (mU/mL)	Reference
Fluorescence	10-2000	3	4
Fluorescence	4.6-383.3	1.4	S2
Colorimetry	5-100	3.3	S3
Colorimetry	0-120	5.4	5
Raman	1-10000	1	29
Raman	0.4-20	0.04	This work

Supplementary References

S1 P. Hildebrandt and M. Stockburger, *The Journal of Physical Chemistry*, 1984, **88**, 5935.

S2 Z. Qian, L. Chai, C. Tang, Y. Huang, J. Chen and H. Feng, *Anal. Chem.*, 2015, **87**, 2966.

S3 Z. Gao, K. Deng, X.-D. Wang, M. Miro and D. Tang, *ACS Appl. Mater. Interfaces*, 2014, **6**, 18243.