Supplementary information

Intra-Nanogap Controllable Au Plates as Efficient, Robust, and Reproducible Surface-Enhanced Raman Scattering-Active Platforms

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The enhancement factor (EF) of the porous plate was estimated using the equation:[1]

$$EF = (I_{plate}/N_{plate})/(I_{normal}/N_{normal})$$

where I_{plate} and N_{plate} are the intensity and the number of 4-ABT contributing to the SERS signals, respectively. I_{normal} and N_{normal} are the intensity and the numbers of 4-ABT contributing to the normal Raman signals, respectively.

As the peak intensity at 1,141 cm^{-1} for 4-ABT, I_{plate} and I_{normal} are 5270 and 24, respectively. N_{plate} and N_{normal} are the number of adsorbed 4-ABT on the porous plate and Si substrate within the laser spot size, respectively, and estimated as follows:[2]

$$N_{plate} = 7 \times (2 \times A/2 \times \pi \times d) / (0.39 \times 10^{-18}) = 56.1 \times 10^{3}$$

$$N_{normal} = 5 \times 10^{-6} \times 0.1 \times 6.02 \times 10^{23} \times \pi \times (A/2)^2/s^2 = 0.945 \times 10^{10}$$

where A is the laser spot size (1 μm), d is the thickness of porous region (100 nm), and s is the edge length of the Si substrate (5 mm). Finally, the estimated EF value was 3.7×10^{7}.

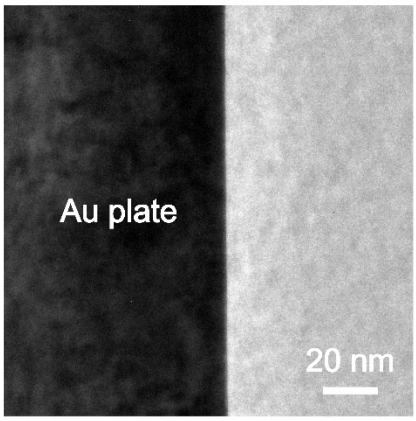

Fig. S1 Cross-sectional TEM image of the Au nanoplate.

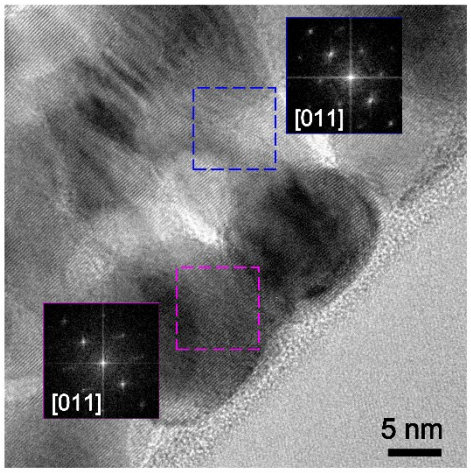

Fig. S2 HR-TEM image of the nanoporous Au plate. Insets are FFT patterns of dashed line boxes.

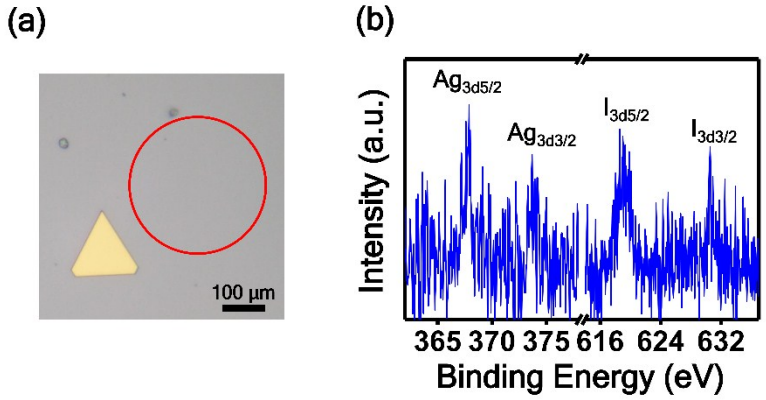

Fig. S3 (a) Optical image of the AuAg alloy nanoplate on a substrate. (b) XPS spectra obtained from the red circle in (a).

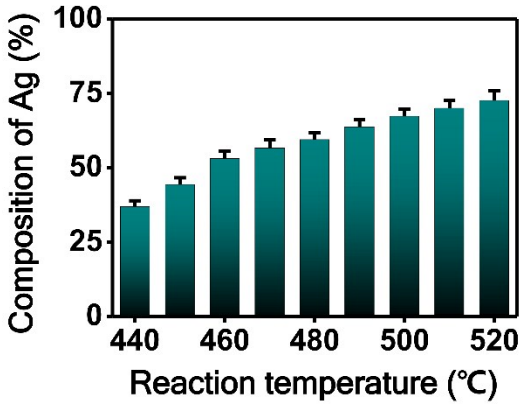

Fig. S4 Composition of Ag on the surfaces of AuAg alloy nanoplates synthesized at temperatures ranging from 440 to 520°C with intervals of 10°C. The atomic ratio of Ag increases from 36.9 to 72.6% as the reaction temperature increases from 440 to 520°C. Data represent the mean plus standard deviation from twelve measurements.

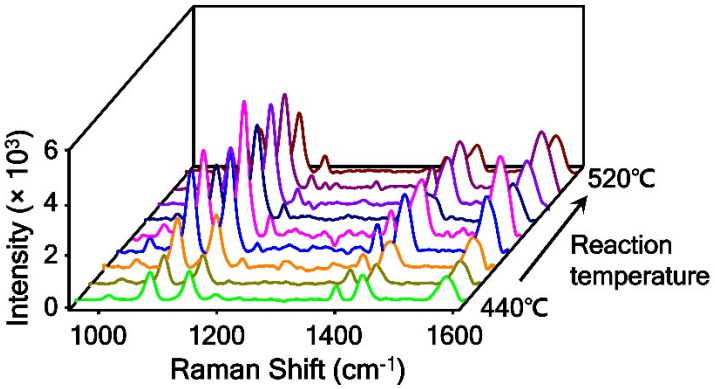

Fig. S5 Full SERS spectra of 4-ABT measured on nanoporous Au plates depending on the reaction temperatures from 440 to 520°C.

Reference

1. G. Eom, H. Kim, A. Hwang, H. Y. Son, Y. Choi, J. Moon, D. Kim, M. Lee, E. K. Lim and J. Jeong, *Advanced Functional Materials*, 2017, **27**, 1701832.
2. J. Qi, P. Motwani, M. Gheewala, C. Brennan, J. C. Wolfe and W. C. Shih, *Nanoscale*, 2013, **5**, 4105–4109.