Supporting Information

Gold nanoplate-based three-dimensional hierarchical microparticles: A single particle with high surface-enhanced Raman scattering enhancement

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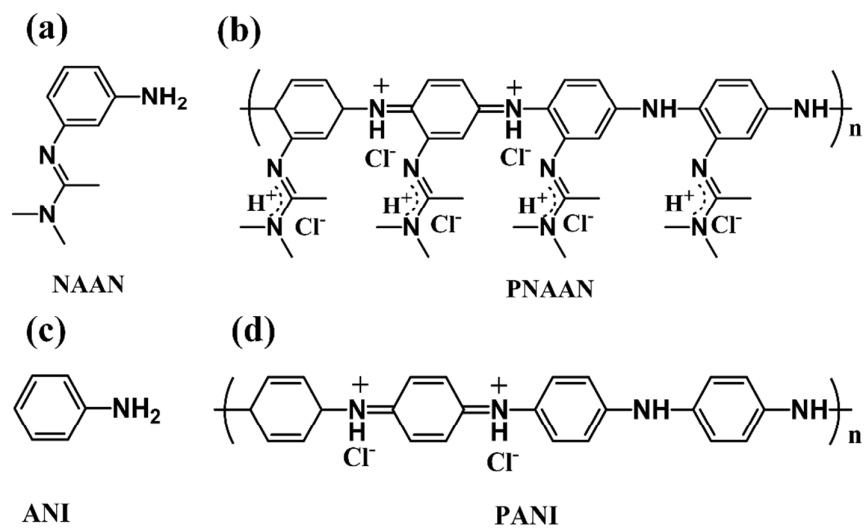
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Figure S1. The chemical structures of (a) NAAN, (b) PNAAN, (c) ANI and (d) PANI.
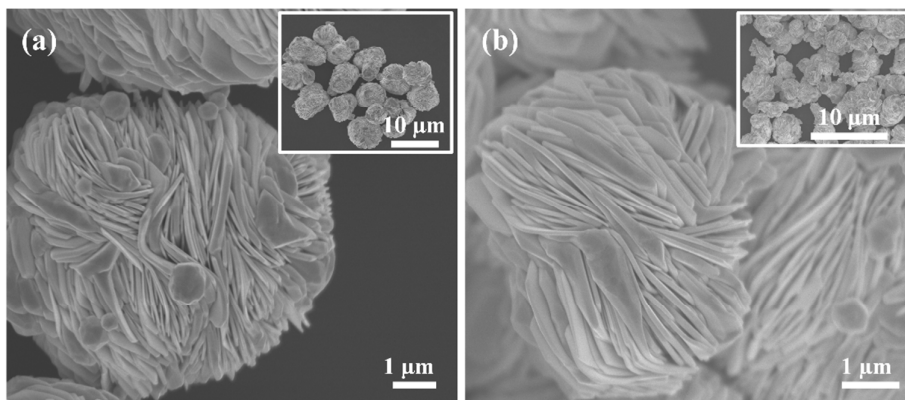
Figure S2. Representative SEM images of Au microparticles obtained in reaction with different concentration of PVP: (a) 8, (b) 32 mg/ml. Reaction condition: $HAuCl_4$ 2 mM, NAAN 16 mM in 1 ml 1 mM HCl at 4°C.
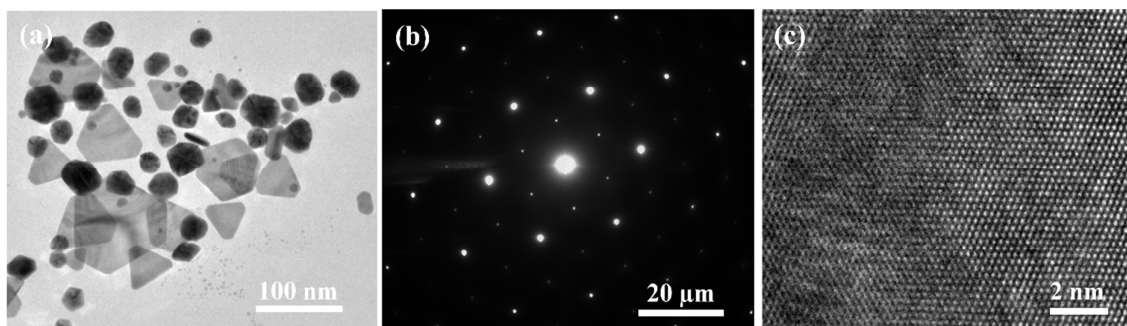
Figure S3. (a) TEM image of Au nanoparticles acquired at 10 min, (b) SAED pattern and (c) fast fourier transform (FFT) pattern of a single Au nanoplate.

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ZAF Method Standardless Quantitative Analysis
Fitting Coefficient : 0.5198
Element    (keV)   mass%  Error%    At%  Compound   mass%    Cation         K
C  K       0.277   10.24   0.16    62.48                                4.0721
N  K       0.392    0.73   0.74     3.85                               0.9342
O  K       0.525    0.13   0.41     0.57                               0.1110
Au M       2.121   88.90   0.81    33.09                              99.1251
Total             100.00          100.00
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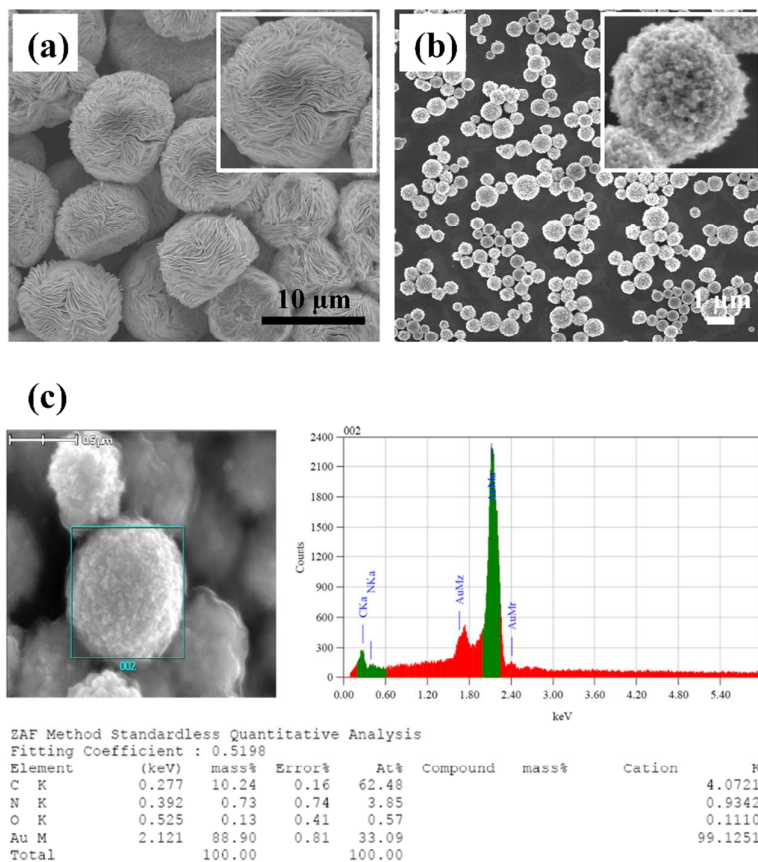
Figure S4. SEM images of Au nanostructures synthesized using (a) NAAN and (b) ANI as the reducing agent, respectively. Reaction condition: Addition of 8 mM (a) NAAN or (b) ANI into 2 mM HAuCl4 in 1 mM HCl containing 1.6 mg PVP for 24 h. (c) EDX spectra of Au-PANI hybrid nanoparticles.

Enhancement factor estimation

The enhancement factor (EF) of the individual AuNFs was estimated according to the following equation:

$$EF = \frac{I_{SERS}}{I_{Normal}} \times \frac{N_{normal}}{N_{SERS}}$$

Where I_{sers} and I_{normal} are the Raman signal intensities of SERS and normal powder samples at the same band (1070 cm^{-1}). N_{SERS} and N_{normal} are the corresponding number of 4-MBA molecules in the focused incident laser spot.

N_{SERS} was calculated according to the following equation:

$$N_{SERS} = \pi r^2 \times D \times N_A = 3.4 \times 10^7$$

Where r is the radius of laser beam (1.9 μm), D is the binding density of 4-MBA monolayer, N_A is the Avogadro's number (6.02×10^{23}). We assumed that the bonding density D of 4-MBA self-assemble monolayer was 0.5 nmol/cm^2.

N_{normal} was calculated using the following equation:

$$N_{normal} = (\frac{\pi \times r^2 \times h \times D}{M}) \times N_A = 1.5 \times 10^{12}$$

Where D is the density of bulk 4-MBA (1.5 g/cm^3), M is the molar mass of 4-MBA (154.2 g/mol), N_A is Avogadro's number (6.02×10^{23} mol^{-1}), r is the radius of the laser beam (1.9 μm), h is the focal depth of the laser (~22 μm).