Supporting information

In Situ Synthesis of Low-Cost and Large-Scale Flexible Metal Nanoparticle-Polymer Composites Film as Highly Sensitive SERS Substrate for Surface Trace Analysis

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Fig.S1. Photographs of the reaction medium after the reduction reaction (from left to right: pure ethanol; ethanol/water binary solution with a volume ratio of 7:1; 5:1; 3:1; 2:1; and pure water, respectively).

Fig. S2. SERS spectra of 1×10^{-6} M p-ATP on the as-prepared film (A) with different Ag content and (B) treated with different concentration of nitric acid.

Fig. S3. SEM images of the AgNPs@CA films that were prepared at different Ag content. The mass ratio of the Ag element in the initial DMF solution containing 0.6g CA was (A) 10 mg/g; (B) 5.0 mg/g; (C) 2.5 mg/g; (D) 1.25 mg/g, respectively.

Fig. S4 (A) SERS spectra of p-ATP with different concentrations; (B) Calibration plot of the SERS intensity at 1581cm^{-1} of P- ATP dropped on the substrates with its concentration.

Text S1: Calculation of SERS Enhancement Factor (EF)

Fig. S5. (a) Normal Raman spectrum of bulk p-ATP, and (b) SERS spectra of 5×10^{-8} M p-ATP on the AgNPs@CA composite film.

Fig. S6. SEM images of the AuNPs@CA composite films that were prepared at different Au content. The mass ratio of the Au element in the initial DMF solution containing 0.6g CA was (A) 2.5 mg/g; (B) 5.0 mg/g; (C) 10.0 mg/g; (D) 20 mg/g, respectively.

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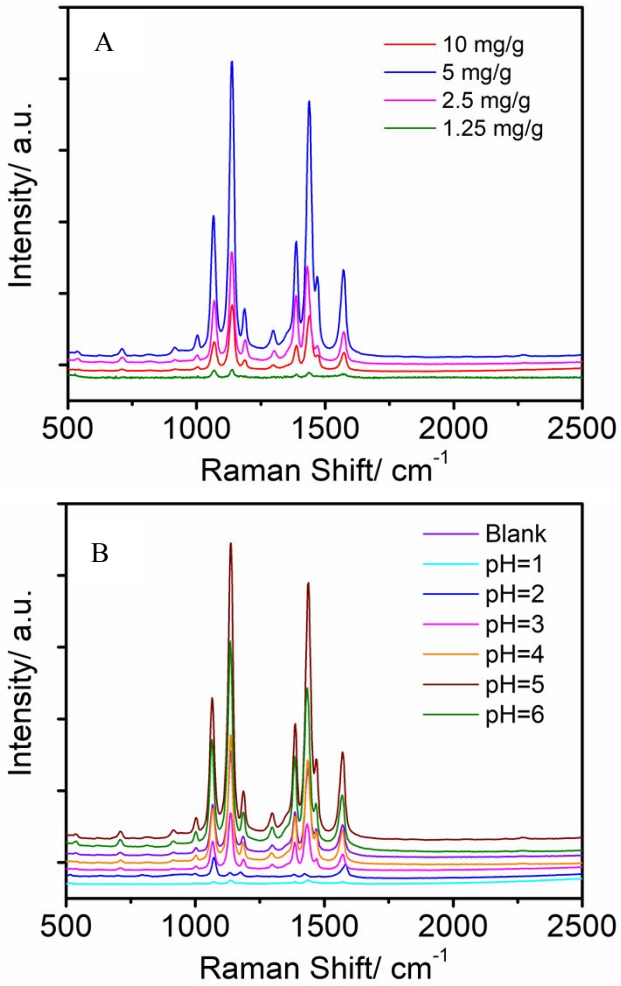
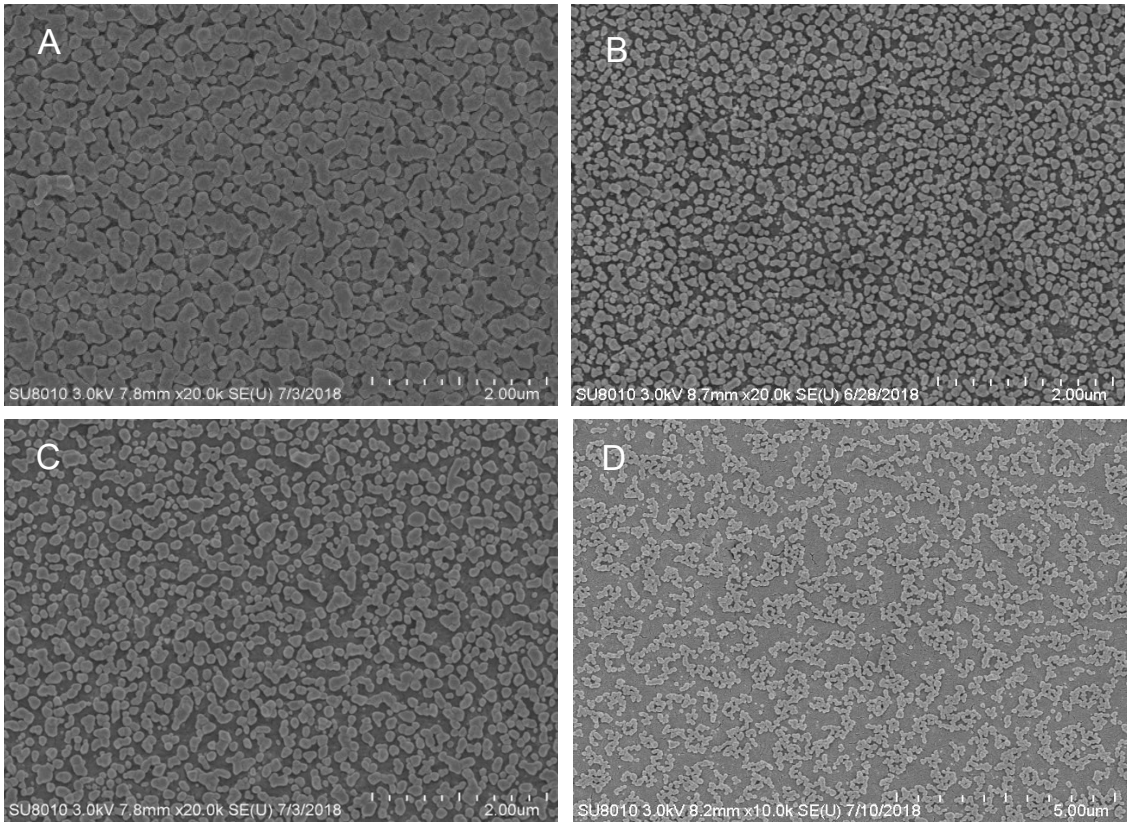


Fig. S2. SERS spectra of 1×10^{-6} M p-ATP on the as-prepared film (A) with different Ag content and (B) treated with different concentration of nitric acid.



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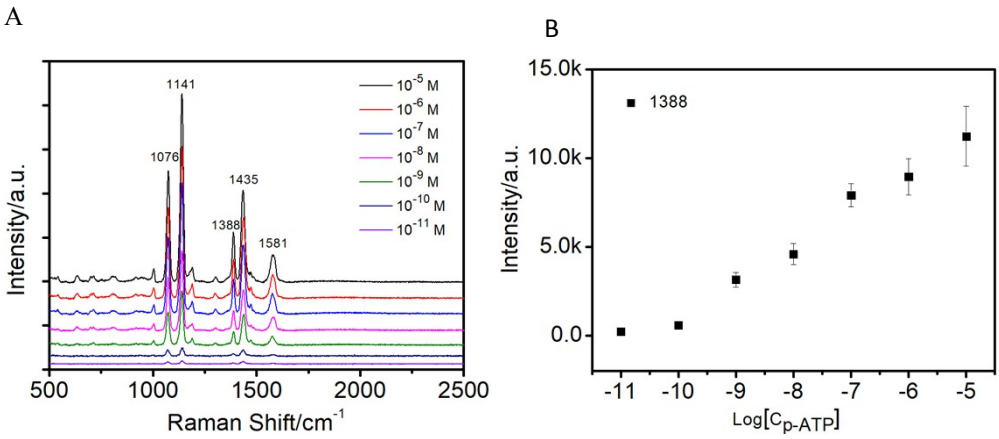
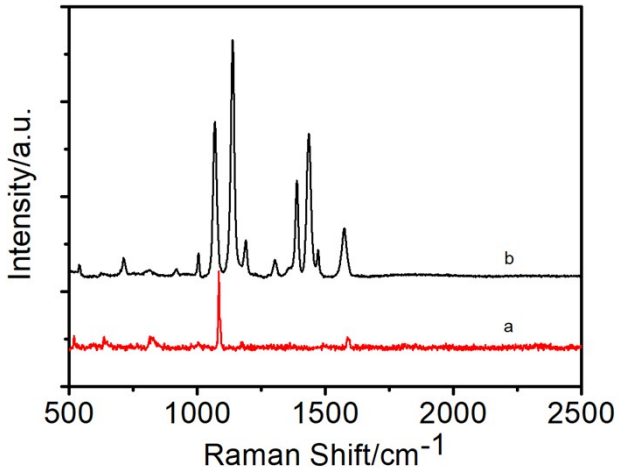


Fig. S4 (A) SERS spectra of p-ATP with different concentrations; (B) Calibration plot of the SERS intensity at 1388cm^{-1} of p- ATP dropped on the substrates with its concentration.

Text S1:

Calculation of SERS Enhancement Factor (EF). By takin p-ATP as the test molecule, the EF of the AgNPs@CA composite film as SERS substrate was estimated by the following formula EF = $(I_{SERS} / I_{bulk}) \cdot (N_{bulk} / N_{surf})$ [1-3], where I_{SERS} and I_{bulk} are the vibration intensities in the SERS and normal Raman spectra of p-ATP, respectively. N_{surf} and N_{bulk} are the number of adsorbed molecules on the AgNPs@CA composite film and the solid p-ATP molecules within the laser spots, respectively. In detail, for determination of N_{surf} and $N_{bulk,}$ we dropped the p-ATP solution (5×10^{-8} M, 5 μL of) on the obtained AgNPs@CA composite film with an area of about 0.5 cm^2. Therefore, the average surface density of p-ATP was calculated as 5×10^{-13}mol/cm^2. Taking the sample area (ca. 10 μm in diameter) into account, N_{surf} has a value of 3.93×10^{-17} mol ($N_{surf} = 5 \times 10^{-13}$ mol/$cm^2 \times \pi \times 25$ $\mu m^2 = 3.93 \times 10^{-19}$ mol). Taking the laser spot (10 μm), the penetration depth (about 2 μm), the density of the solid p-ATP (1.18 g/cm^3) into account, N_{bulk} had a value of 1.48×10^{-12} mol in the detected solid sample area. The intensity of the vibrational mode at 1581 cm^{-1} was used to calculate the EF value. All spectra were normalized for acquisition time and laser power. The EF was calculated to be 1.8×10^7 for the AgNPs@CA composite film.



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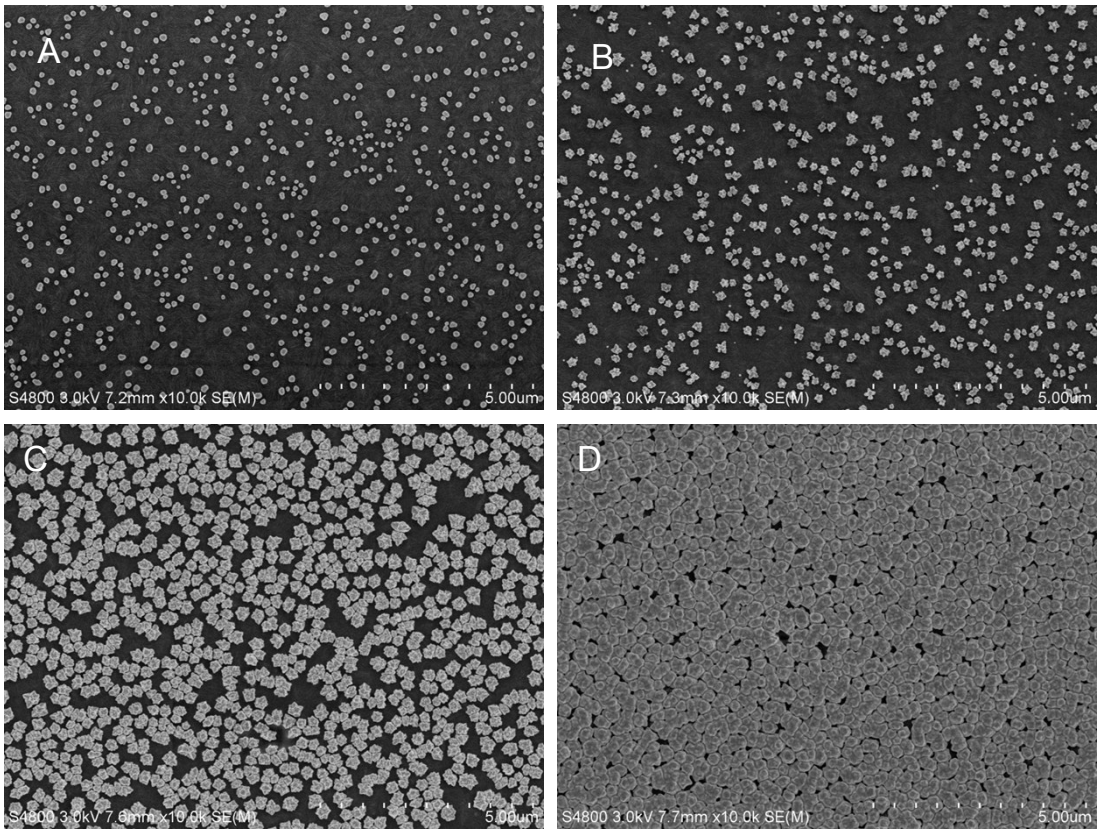

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