Polymer induced one-step interfacial self-assembly method for the fabrication of flexible, robust and free-standing SERS substrates for rapid on-site detection of pesticide residues

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EF calculation

Enhanced factor was calculated by the equation as below:

$$EF = \frac{I_{SER} / N_{SER}}{I_{NRS} / N_{NRS}} \approx \frac{cN_A \sigma h I_{SER}}{R I_{NRS}}$$

where c is the concentration of 4-ATP in ethanol, N_A is the Avogadro constant, σ is the surface area occupied by an adsorbed 4-ATP molecule, and R is the roughness factor of the AuNPs/PVC film, h is the effective waist. In this work, c is 0.01 $mol \cdot L^{-1}$, N_A is 6.02×10^{23} mol^{-1}, σ is 0.2 nm^2, h is 60 μm, R is 2, the calculated result was 3.7×10^6.

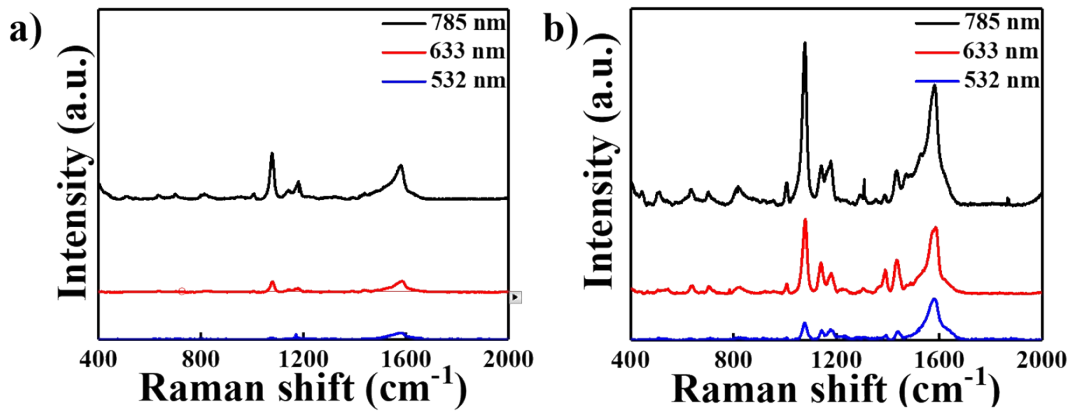

Fig. S1 Raman spectra of AuNPs/PVC films labelled by 4-ATP probe molecules under 785, 633, 532 nm laser radiation as the excitation sources. (a) The $AuNPs_{20}$/PVC film and (b) the $AuNPs_{50}$/PVC film. The intensity has been normalized due to different laser power.

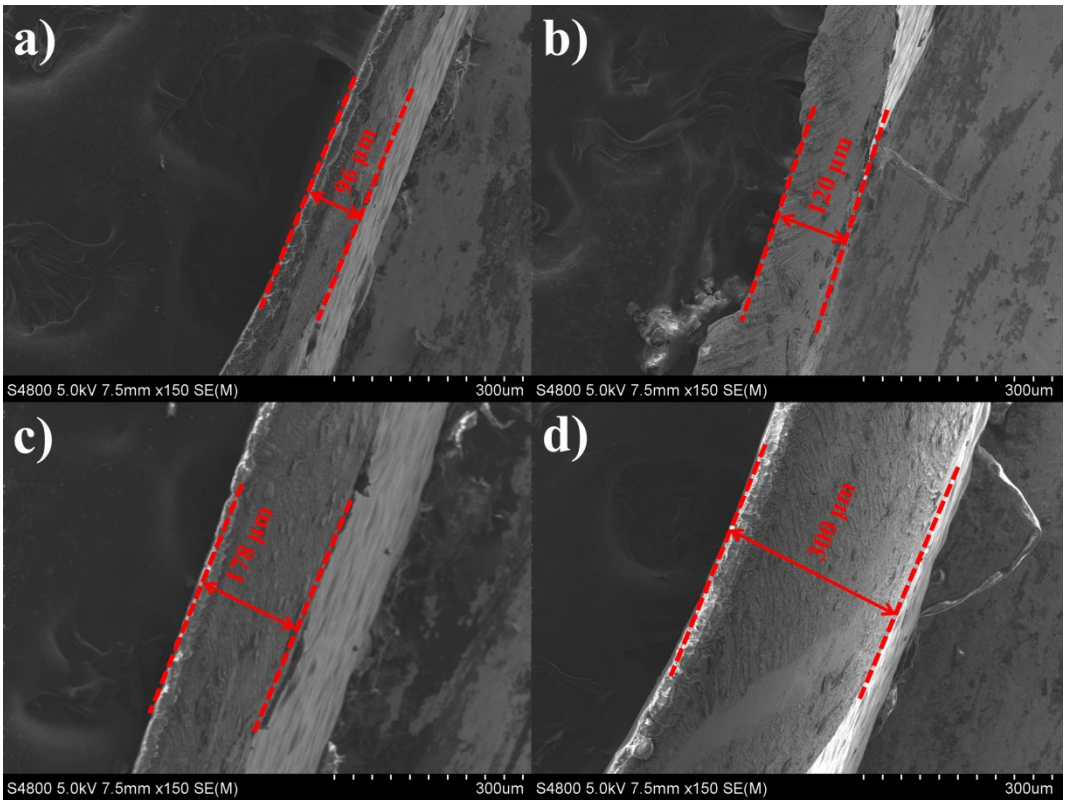

Fig. S2 SEM images of the section of AuNPs/PVC films with different PVC content. (a) 1.2 mg/cm^2, (b) 3.1 mg/cm^2, (c) 6.2 mg/cm^2, (d) 12.4 mg/cm^2.

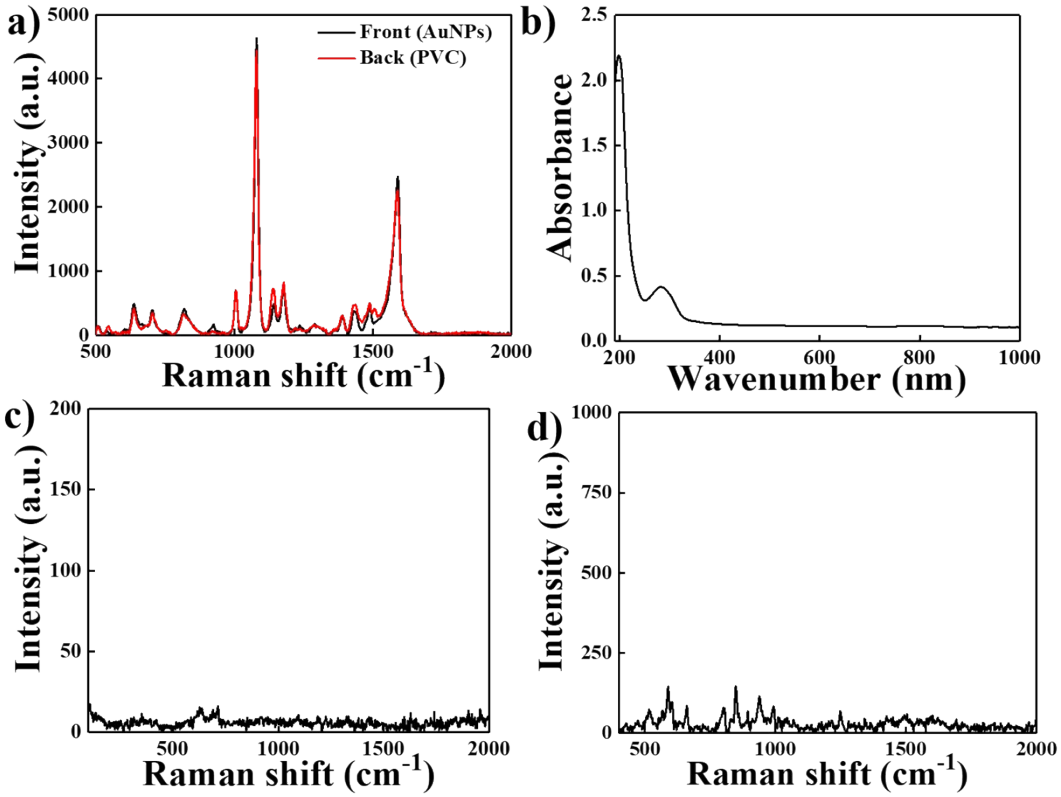

Fig. S3 a) Raman spectra of 4-ATP detected by AuNPs/PVC film in the front and back side. Front side was full of assembled AuNPs, back side was the PVC template. b) UV-vis spectrum of 6.2 mg/cm^2 PVC film. c) Raman spectrum of PVC template. d) Raman spectrum of the AuNPs/PVC film. Laser wavelength =785 nm; laser power = 0.27 mW; integration time = 5 s.

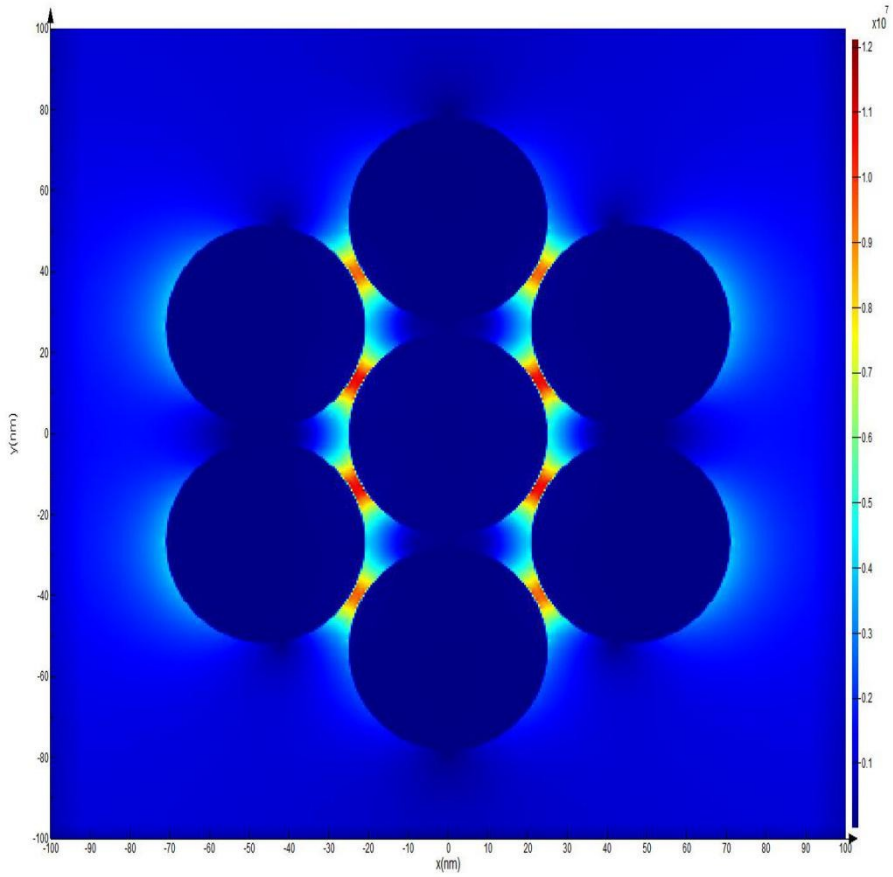

Fig. S4 FDTD simulated intensity distribution of electrical field for the AuNPs/PVC film irradiated by 785 nm laser light.

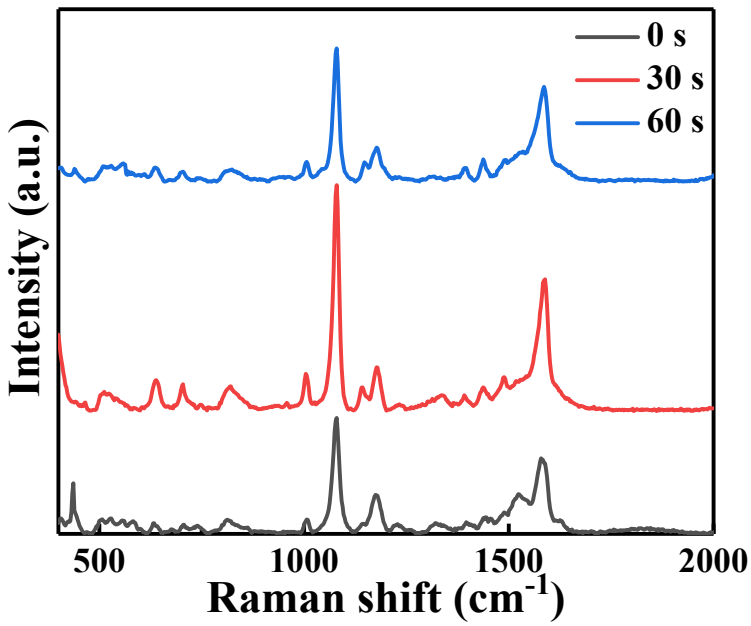

Fig. S5 SERS signals of the AuNPs/PVC film after different time plasma treatment. Experimental conditions: Laser wavelength = 785 nm; laser power = 0.27 mW; integration time = 5 s.

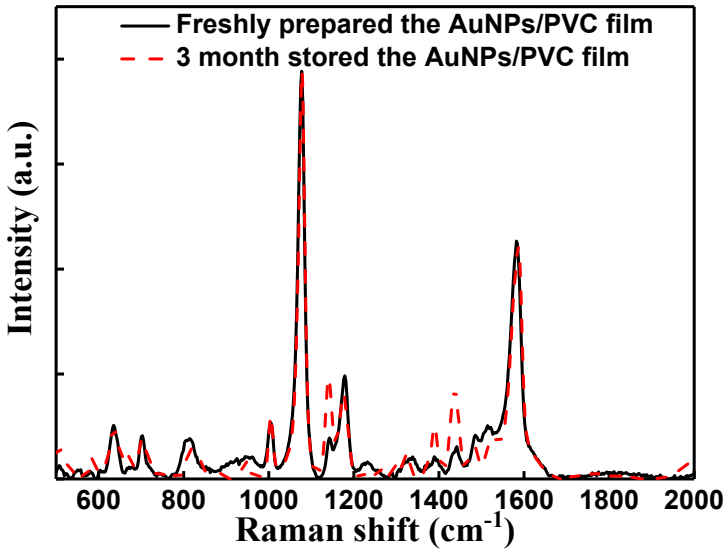

Fig. S6 SERS spectra of 4-ATP collected from the freshly prepared AuNPs/PVC film (black) and the same substrate after 3 months storage (red, dashed). Experimental conditions: Laser wavelength = 785 nm; laser power = 0.27 mW; integration time = 5 s.