Electronic Supplementary Material (ESI) for Analyst.

Supporting Information

Flexible transparent Ag-NCs@PE film as cut-and-paste SERS substrates for rapid *in-situ* detection of organic pollutants

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Supporting Information

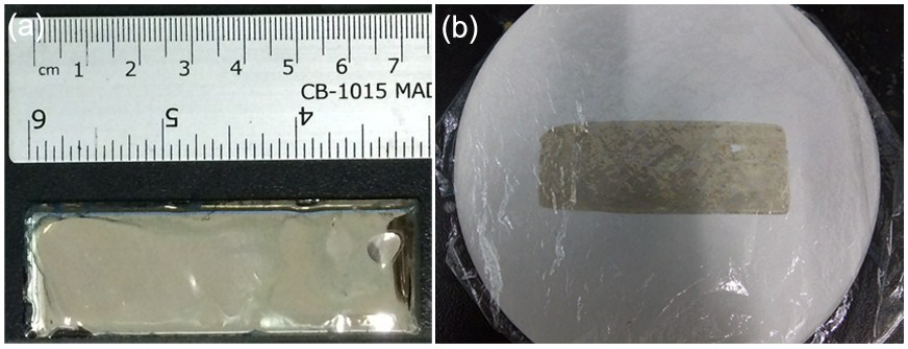

Fig. S1 Photograph of (a) the resultant Ag-NCs monolayer covered at the glass slide (b) the Ag-NCs monolayer coated on the PE film.

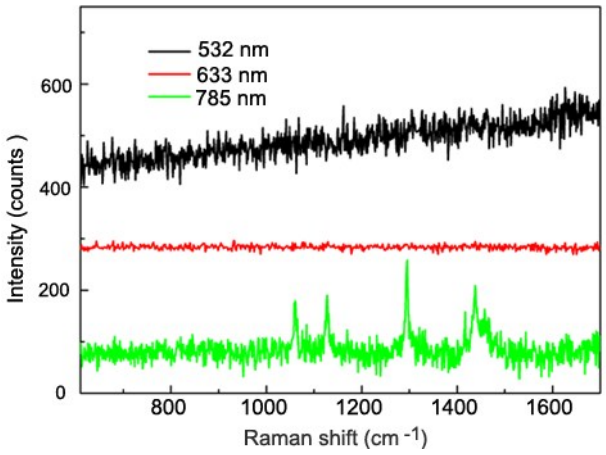

Fig. S2 Raman spectra of pure PE film to be used for retrieving Ag-NCs monolayer, obtained at three excitation lines (532, 633, 785 nm). Experimental conditions: Laser wavelength = 532 nm; laser power = 0.05 mW; Laser wavelength = 633 nm; laser power = 0.16 mW; Laser wavelength = 785 nm; laser power = 0.25 mW. The integration time is 5 s.

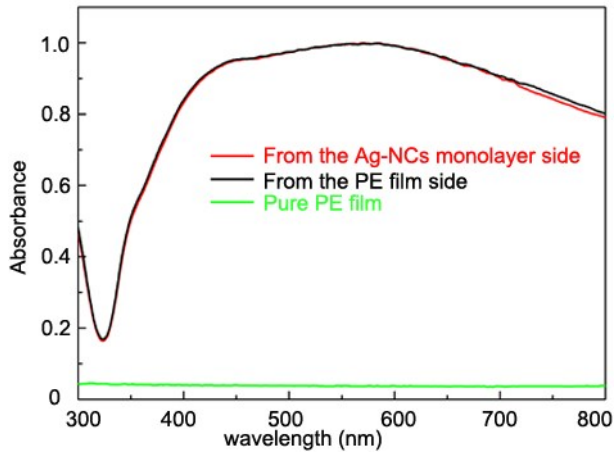

Fig. S3 The UV absorption spectra conducted from both side of the Ag-NCs@PE composite film and pure PE film.

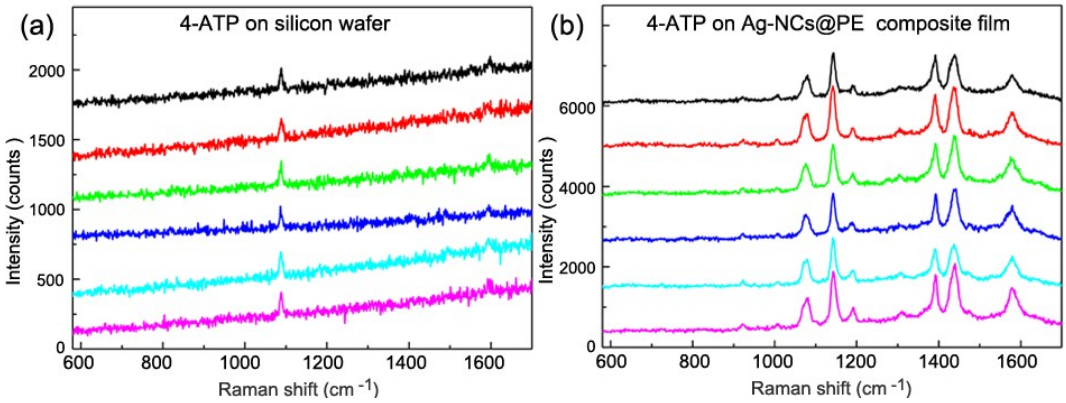

Fig. S4. (a) Normal Raman spectrum of 4-ATP ethanol solution obtained using dried 200 μL 10 mM 4-ATP ethanol solution dispersed on 120 mm^2 Si wafer at the excitation wavelength of 532 nm. (b) SERS spectrum of 50 μL 1 nM 4-ATP ethanol solution dispersed on 225 mm^2 the Ag-NCs@PE composite film at the excitation wavelength of 532 nm.

We used 4-ATP as probe molecule to estimate the averaged enhancement factor (EF). The EF of the Ag-NCs@PE composite film was calculated in light of the equation:

$$EF = \frac{I_{SERS}/N_{SERS}}{I_{Nor}/N_{Nor}}$$

Where I_{SERS} and I_{Nor} reprensent the relative characteristic peak intensities of 4-ATP from SERS signal and normal Raman signal, respectively. N_{SERS} and N_{Nor} are the corresponding numbers of 4-ATP molecule on the substrates within the laser spot area, respectively. For simplification, N_{SERS} and N_{Nor} could be calculated as follows:

$$N_{SERS} = n_{SERS}N_A = \frac{V_{SERS}C_{SERS}}{S_{SERS}}N_A$$

$$N_{Nor} = n_{Nor}N_A = \frac{V_{Nor}C_{Nor}}{S_{Nor}}N_A$$

Where n_{SERS} represent that a certain volume (V_{SERS}) and concentration (C_{SERS}) 4-ATP water solution was dispersed to an area of S_{SERS} on the Ag-NCs@PE composite film; n_{Nor} represent that a certain volume (V_{Nor}) and concentration (C_{Nor}) 4-ATP ethanol solution was dispersed to an area of S_{Nor} at a clean Si wafer substrate. N_A represents Avogadro constant. Thus, the equation can be

rewritten as follows:

$$EF = \frac{I_{SERS}}{I_{Nor}} \cdot \frac{S_{SERS} V_{Nor} C_{Nor}}{S_{Nor} V_{SERS} C_{SERS}}$$

In our experiments, 200 μL of 10 mM 4-ATP ethanol solution was dispersed to an area of about 120 mm^2 on Si wafer to record the Raman spectrum (Fig. S4a), and 50 μL of 1 nM 4-ATP ethanol solution was dispersed to on an area of about 225 mm^2 on the Ag-NCs@PE composite film for SERS spectra (Fig. S4b). Taking 1079 cm^{-1} band for estimation, I_{SERS}/I_{Nor} was about 3.34. So the averaged EF for the band at 1079 cm^{-1} is calculated to be about 2.5×10^8.

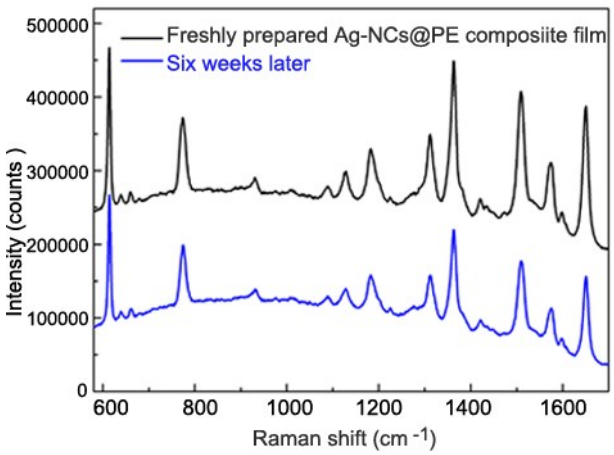

Fig. S5. SERS spectra of R6G (1 μM) collected from freshly prepared Ag-NCs@PE composite film and a prepared substrate stored six weeks later at the excitation wavelength of 532 nm.

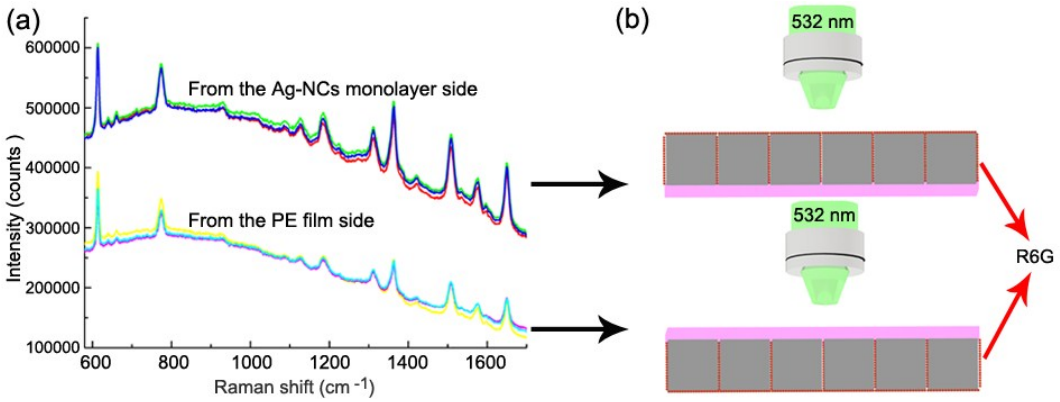

Fig. S6 (a) SERS spectra of R6G (1 μM) collected from both side of the Ag-NCs@PE composite film at the excitation wavelength of 532 nm. (b) Schematic detection process in Fig. S6a.