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Electronic Supplementary Information

Controllable Fabrication of Ag-nanoplates Decorated PAN-nanopillar Arrays and Their Applications in Surface-enhanced Raman Scattering

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Part S1：Fig. S1 to S9

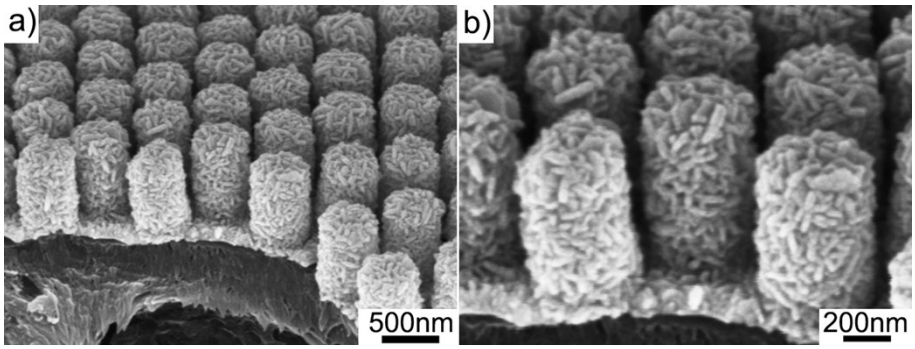


Fig. S1 (a, b) the side-view SEM images of the as-fabricated Ag-nanoplates assembled PAN-nanopillar arrays.

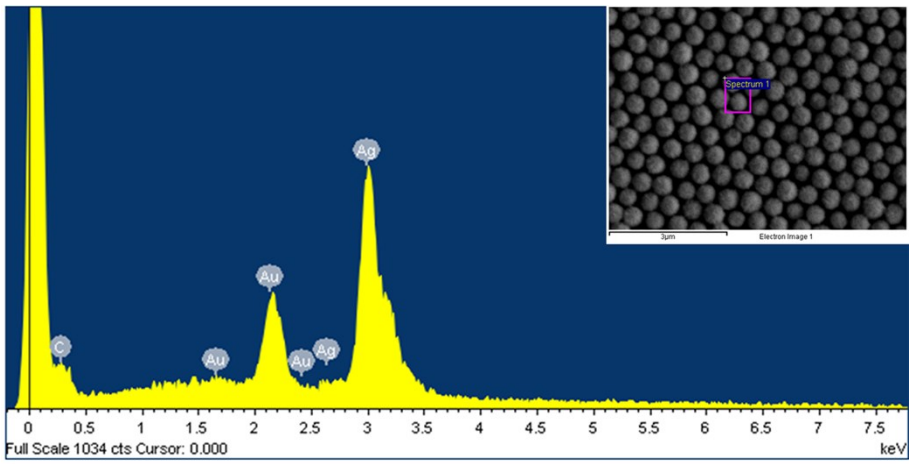


Fig. S2 EDS of the as-prepared Ag-nanoplates assembled PAN-nanopillar arrays (Fig. 2c).

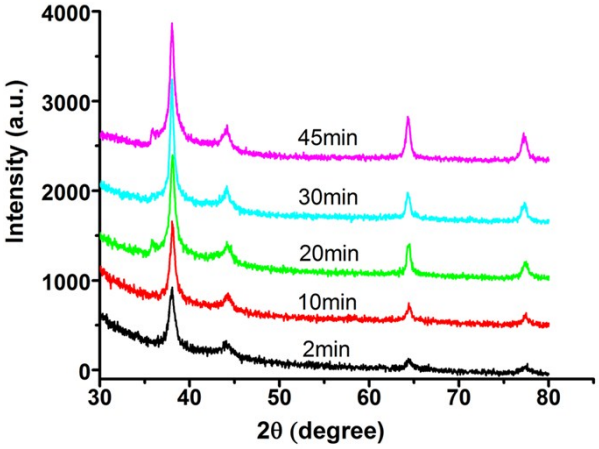


Fig. S3 The XRD patterns of the Ag-NPs@PAN-nanopillar arrays with different deposition durations.

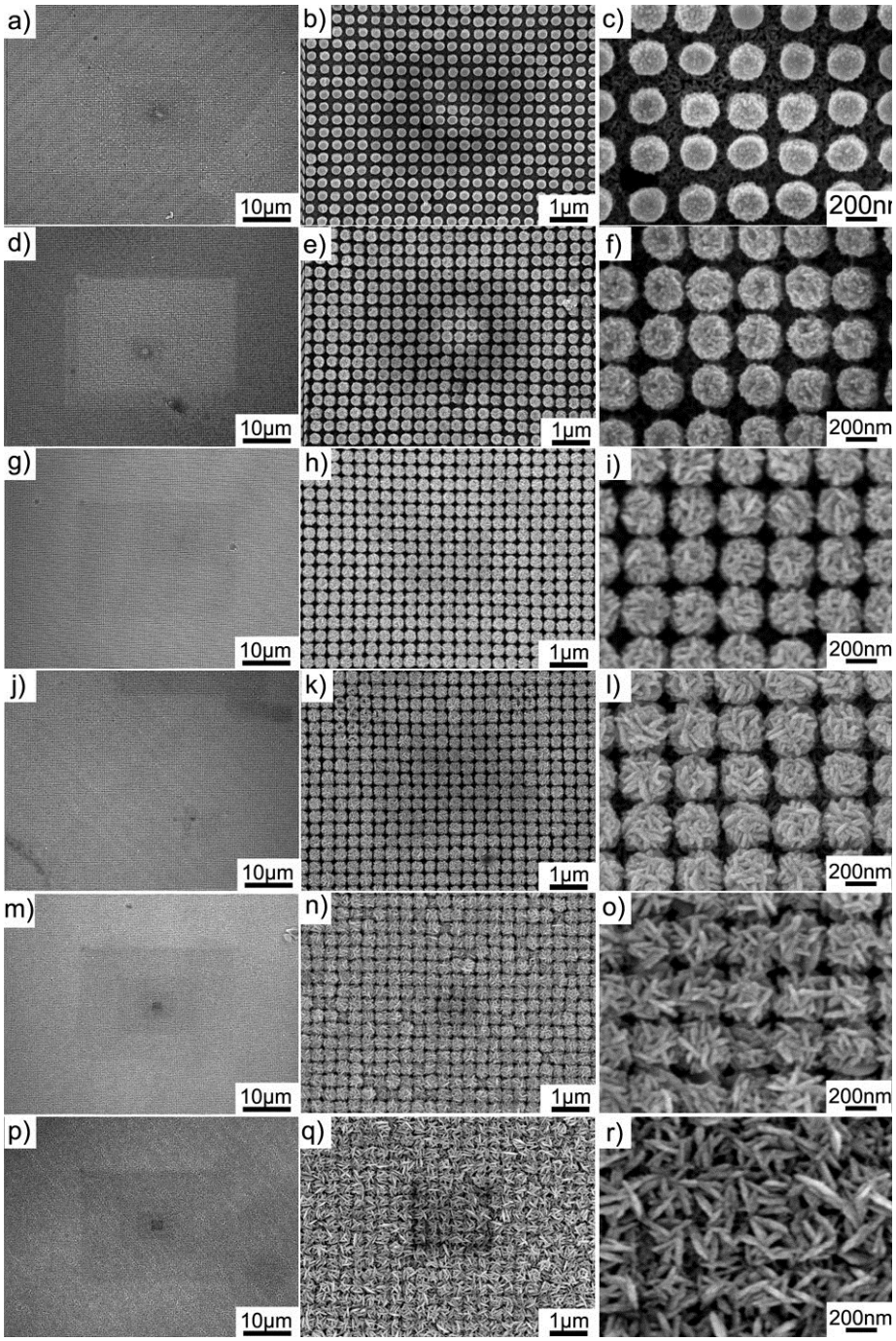


Fig. S4 (a-r) SEM images of the Ag-nanoplates assembled tetragonal PAN-nanopillar arrays (Fig. 3a) with different Ag-deposition durations, a-c)30s; d-f) 1min; g-i) 2min; j-l) 5min; m-o) 10min; p-r) 20min.

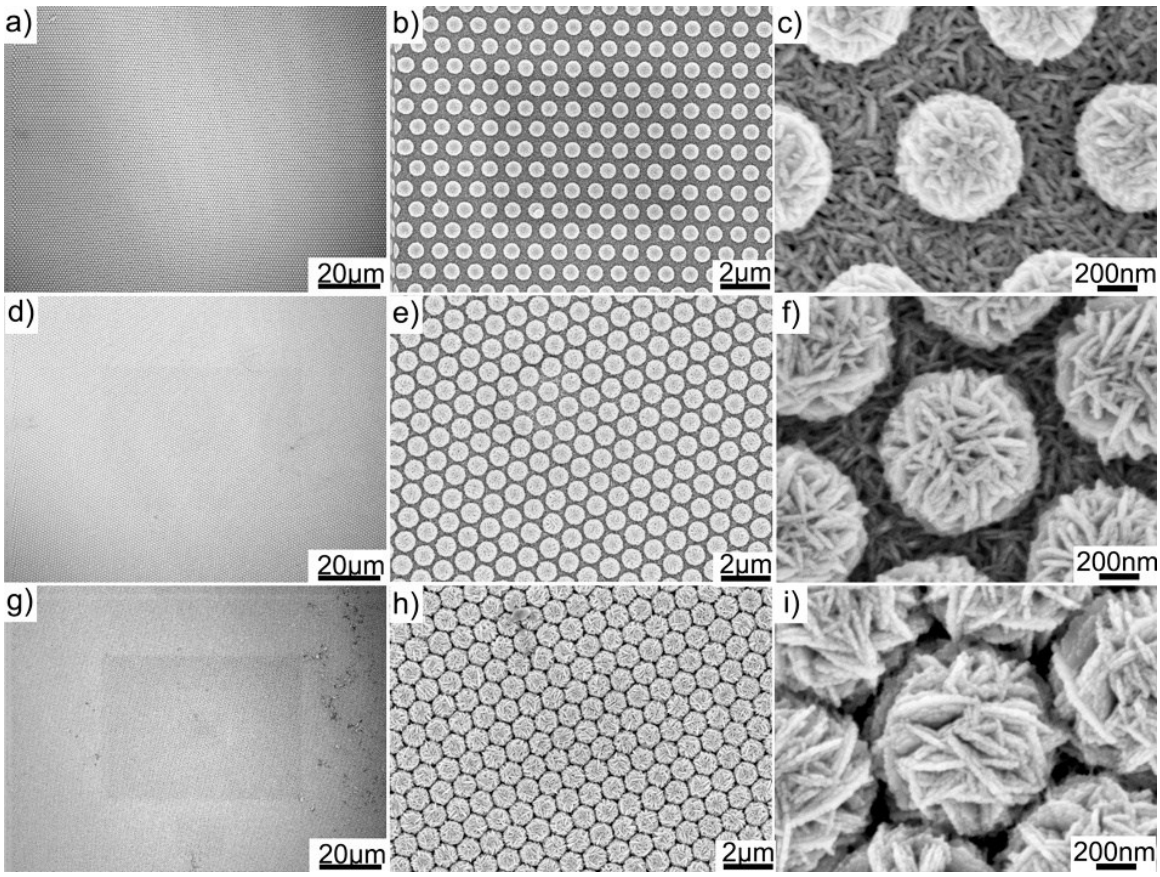


Fig. S5 (a-i) SEM images of the Ag-nanoplates assembled PAN-nanopillar arrays (Fig. 3d) with different Ag-deposition durations, a-c) 5min; d-f) 10min; g-i) 20min.

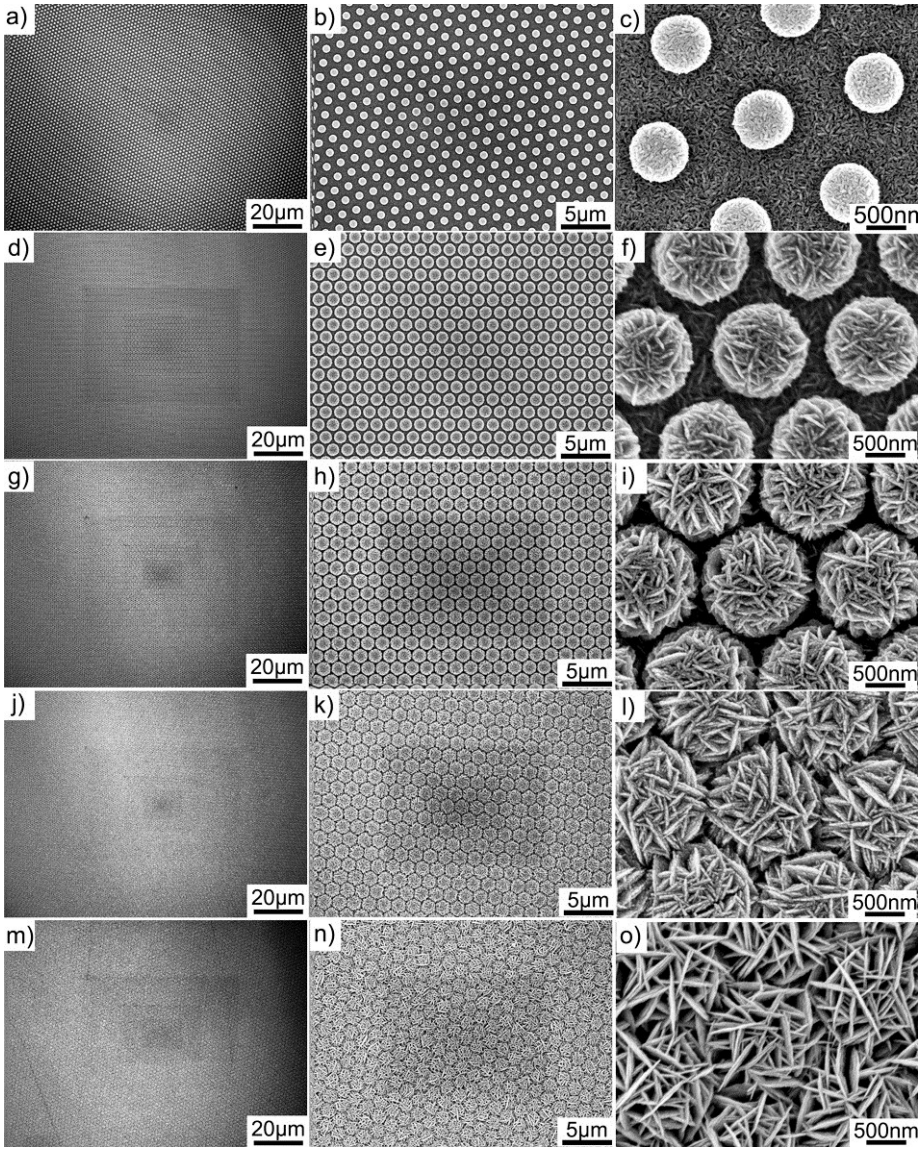


Fig. S6 (a-o) SEM images of the Ag-nanoplates assembled PAN-nanopillar arrays (Fig. 3g) with different Ag-deposition durations, a-c) 5min; d-f) 10min; g-i) 20min; j-l) 30min; m-o) 45min.

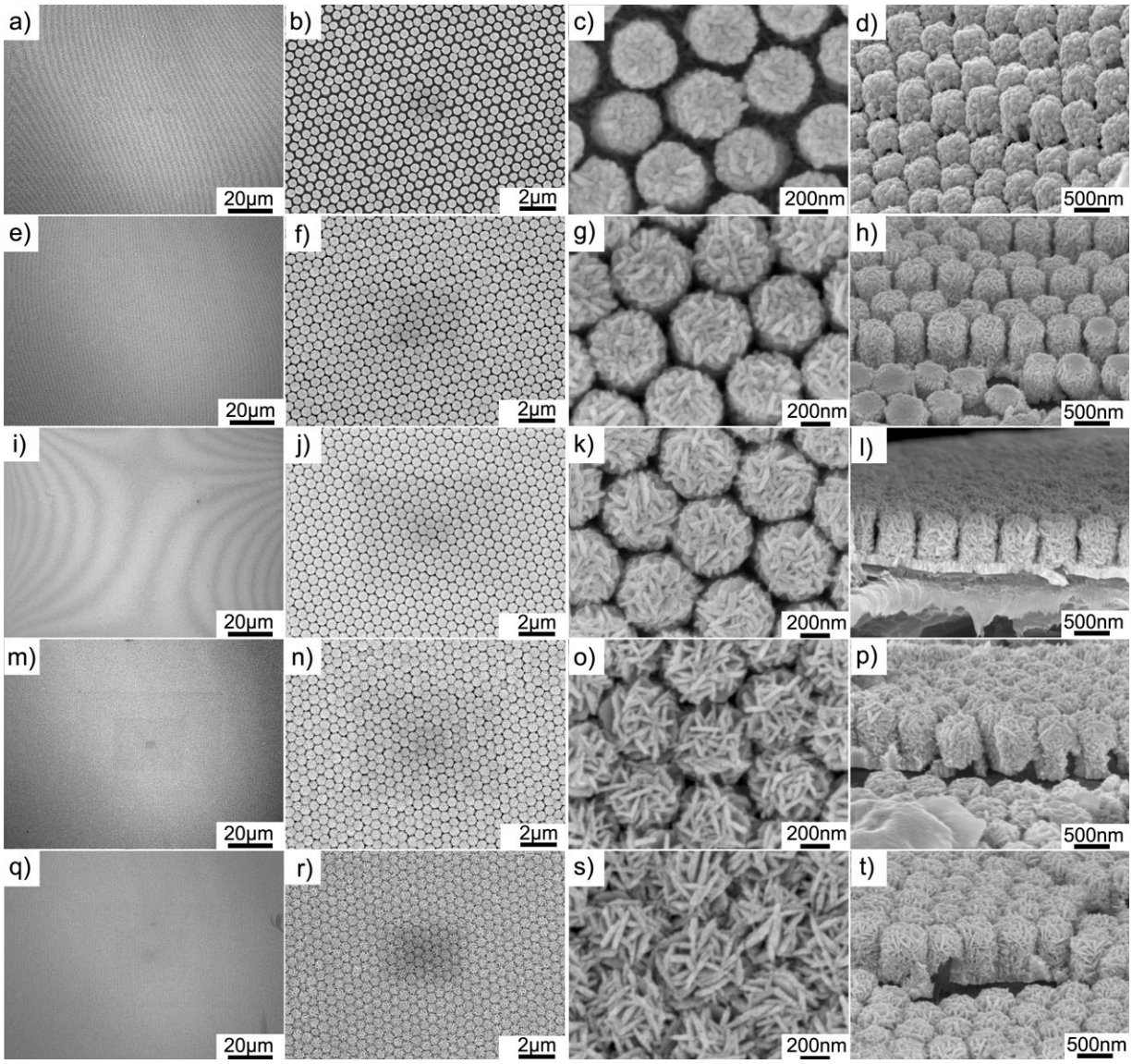


Fig. S7 (a-t) SEM images of the as-prepared Ag-plates assembled PAN-nanopillar arrays (Fig. 2a) achieved with different citric acid, a-d) 0.5g/L; e-h)2 g/L; i-l)4 g/L ; m-p) 8g/L ; q-t)16 g/L.

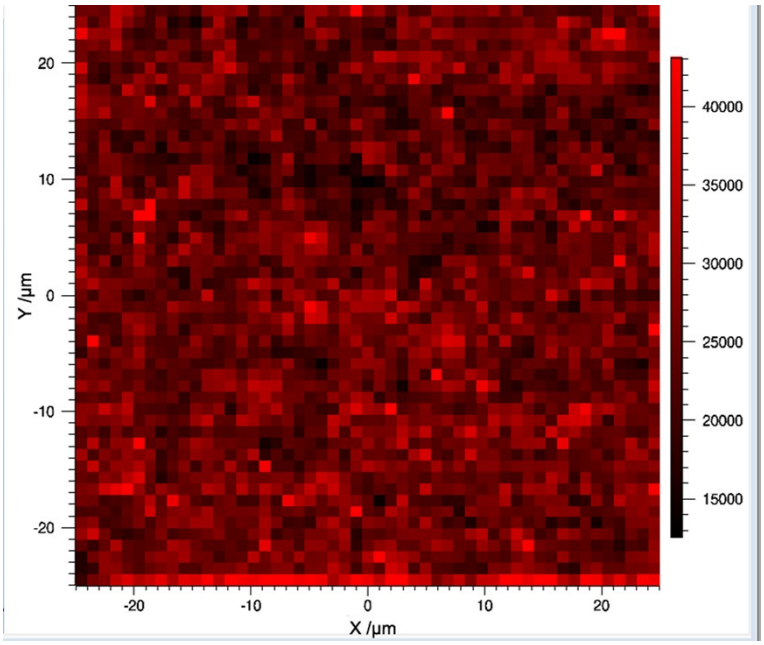


Fig. S8 A SERS intensity map (50μm×50μm) of the 612 cm^{-1} band of R6G observed from the substrate shown in Fig. 4e.

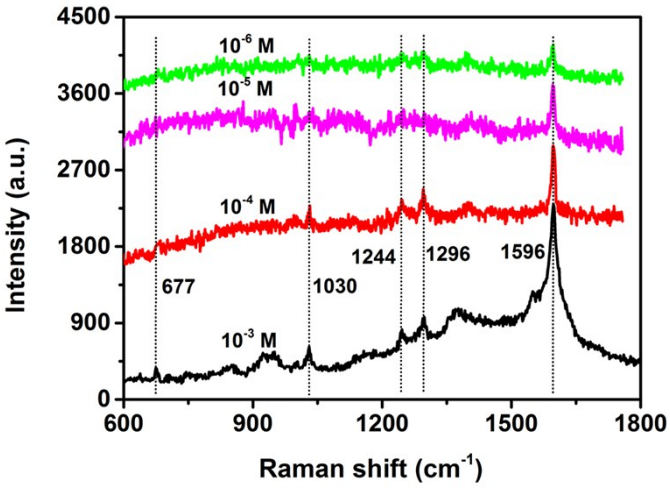


Fig. S9 SERS spectra of 10^{-3}, 10^{-4}, 10^{-5} and 10^{-6} M PCB-77 probed using the substrate shown in Fig. 4e.

Part S2: Estimation of enhancement factor

We used the peak at 1078 cm^{-1} (for 4-ATP) to estimate the enhancement factor (EF). The SERS EF is a quantitative measure of the Raman signal amplification of the analyte. We calculated this value using the reported protocol. The EF can be calculated by:

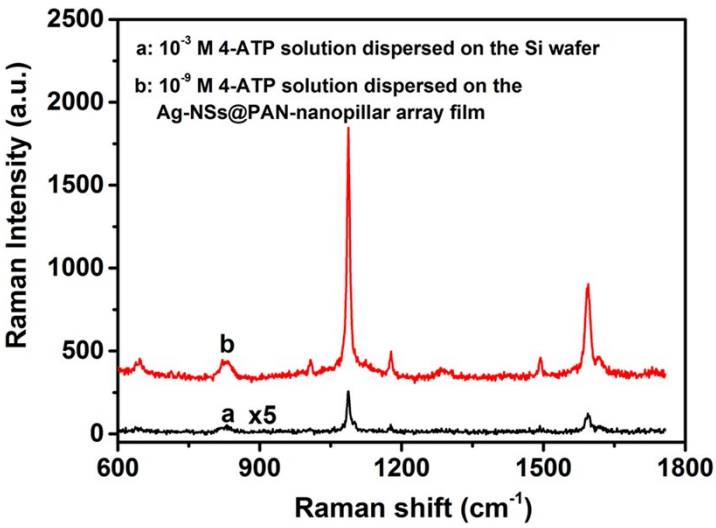
$$EF = \frac{I_{SERS} N_{Ref}}{I_{Ref} N_{SERS}}$$

Where N_{SERS} and N_{Ref} are the number of molecules probed on the Ag-NPs@PAN-nanopillar arrays and on the reference sample, respectively. I_{SERS} and I_{Ref} correspond to SERS signal and the un-enhanced normal signals intensities, respectively. Herein, a certain volume (V_{SERS}) and concentration (C_{SERS}) 4-ATP ethanol solution was dispersed to an area of S_{SERS} at the Ag-NPs@PAN-nanopillar array substrate. For non-SERS Raman spectra, a certain volume (V_{Ref}) and concentration (C_{Ref}) 4-ATP ethanol solution was dispersed to an area of S_{Ref} at a clean Si substrate. Both the substrates were dried in the air. Considering the area of laser spot is the same, the foregoing equation thus becomes:

$$EF = \frac{I_{SERS}}{I_{Ref}} \bullet \frac{C_{Ref} V_{Ref}}{C_{SERS} V_{SERS}} \bullet \frac{S_{SERS}}{S_{Ref}}$$

In our experiment, 1 μL of 1×10^{-9} M 4-ATP ethanol solution was dispersed to an area of 40 mm^2 for the Ag-NPs@PAN-nanopillar array substrate shown in Fig. 4e and 1 μL of 1×10^{-3} M 4-ATP ethanol solution was dispersed to an area of 28 mm^2 for the silicon wafer**.** For the band at 1078 cm^{-1}, I_{SERS}/I_{Ref} was $\frac{1479}{220}$=6.72 Therefore average enhancement factor for the band at 1078 cm^{-1} is calculated to be 9.6×10^6.

Figure for estimation of enhancement factor:



(a) SERS spectrum of 1 μL 10^{-9} M 4-ATP ethanol solution dispersed on 40 mm^2 Ag-NPs@PAN-nanopillar arrays shown in Fig. 4e. (b) Raman spectrum of 4-ATP obtained by dispersing 1 μL 10^{-3} M 4-ATP ethanol solution on 28 mm^2 Si wafer. The exposure time was 60 s.