Electronic Supplementary Information

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

Zhongbo Li,*a b Zhaofang Du,*a Kexi Sun,c Xuan Hed and Bensong Chen*b

College of Light-Textile Engineering and Art, Anhui Agricultural University, Hefei 230036, China
bKey Laboratory of Materials Physics, and Key Laboratory of Nanomaterials and Nanotechnology, Institute of Solid State Physics, Chinese Academy of Sciences, Hefei 230031, China,
cCollege of Physics and Electronic Information, Luoyang Normal University, Luoyang 471022, China
dInstitute of Chemical Materials, China Academy of Engineering Physics, Mianyang 621900, China

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 \( N_{\text{SERS}} \) and \( N_{\text{Ref}} \) are the number of molecules probed on the Ag-NPs@PAN-nanopillar arrays and on the reference sample, respectively. \( I_{\text{SERS}} \) and \( I_{\text{Ref}} \) correspond to SERS signal and the un-enhanced normal signals intensities, respectively. Herein, a certain volume (\( V_{\text{SERS}} \)) and concentration (\( C_{\text{SERS}} \)) 4-ATP ethanol solution was dispersed to an area of \( S_{\text{SERS}} \) at the Ag-NPs@PAN-nanopillar array substrate. For non-SERS Raman spectra, a certain volume (\( V_{\text{Ref}} \)) and concentration (\( C_{\text{Ref}} \)) 4-ATP ethanol solution was dispersed to an area of \( S_{\text{Ref}} \) 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:

\[
EF = \frac{I_{\text{SERS}}}{I_{\text{Ref}}} \cdot \frac{C_{\text{Ref}} V_{\text{Ref}}}{C_{\text{SERS}} V_{\text{SERS}}} \cdot \frac{S_{\text{SERS}}}{S_{\text{Ref}}}
\]

In our experiment, 1 \( \mu \)L of \( 1 \times 10^{-9} \) 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 \( \mu \)L of \( 1 \times 10^{-3} \) M 4-ATP ethanol solution was dispersed to an area of 28 mm\(^2\) for the silicon wafer. For the band at 1078 cm\(^{-1}\), \( I_{\text{SERS}}/I_{\text{Ref}} \) was \( \frac{1479}{220} = 6.72 \) Therefore average enhancement factor for the band at 1078 cm\(^{-1}\) is calculated to be \( 9.6 \times 10^6 \).

**Figure for estimation of enhancement factor:**

(a) SERS spectrum of 1 \( \mu \)L \( 10^{-9} \) 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 \( \mu \)L \( 10^{-3} \) M 4-ATP ethanol solution on 28 mm\(^2\) Si wafer. The exposure time was 60 s.