Supporting Information

Light-Trapping SERS Substrate with Regular Bio-inspired Arrays for Detecting Trace Dyes

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Preparation of PS microspheres (1350 nm)

The PS microspheres with a diameter of 1350 nm were prepared by dispersion polymerization. Firstly, 160 mL of isopropanol and 2.8 g of polyvinylpyrrolidone (PVP) were added into the flask. The temperature of the system was then raised to 70 ℃ under mechanical stirring, while N_2 was introduced to eliminate the influence of oxygen in the system on the polymerization reaction. Subsequently, 20 g of purified styrene and 0.2 g of refined azobisisobutyronitrile (AIBN) were added to the above system and reacted for 24 h. After the reaction, the system was sequentially stirred until the temperature dropped to room temperature. Finally, the PS microspheres were obtained by multiple centrifugations and washings with alcohol and water. Under the action of ultrasound, the PS microspheres were re-dispersed in water, and the solid content of PS microspheres in the water was adjusted to 10 wt%.

Preparation of PS microspheres (180 nm)

The PS microspheres with a diameter of 180 nm were synthesized by emulsion polymerization. Firstly, 20 mL of purified styrene and 200 mL of distilled water were added into the flask. The temperature of the system was then raised to 80 ℃ under mechanical stirring and N_2 protection. After 15 min, 10 mL of an aqueous solution containing 0.052 g of emulsifier sodium dodecyl sulfate (SDS) and 0.620 g of initiator potassium persulfate (KPS) was added into the flask. After 5 h of reaction, the above solution was treated to obtain PS microspheres by multiple centrifugations and washings with alcohol and water. Finally, the PS microspheres were re-dispersed in water under the ultrasound, and the solid content of PS microspheres in the water was adjusted to 10 wt%.

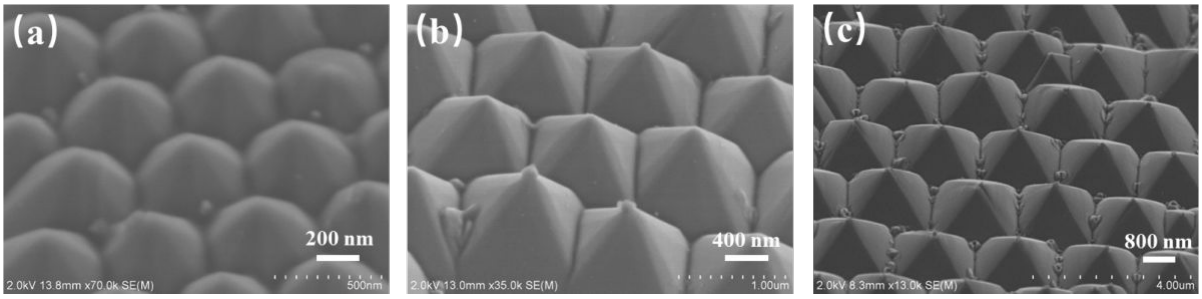

Figure S1. SEM images of the Si pyramid arrays fabricated by using the different periodic PS spheres: (a) 500 nm. (b) 1000 nm and (c) 2000 nm.

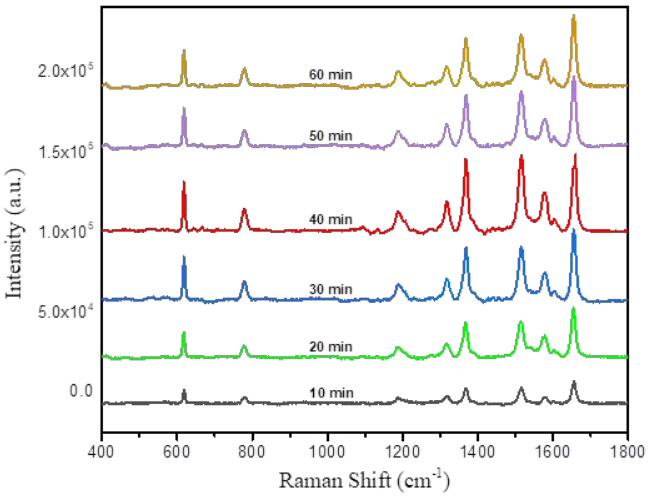

Figure S2. Raman spectra of R6G (10^{-4} M) molecules absorbed on the Ag-NB/Si-P substrates with the different growing time of Ag.

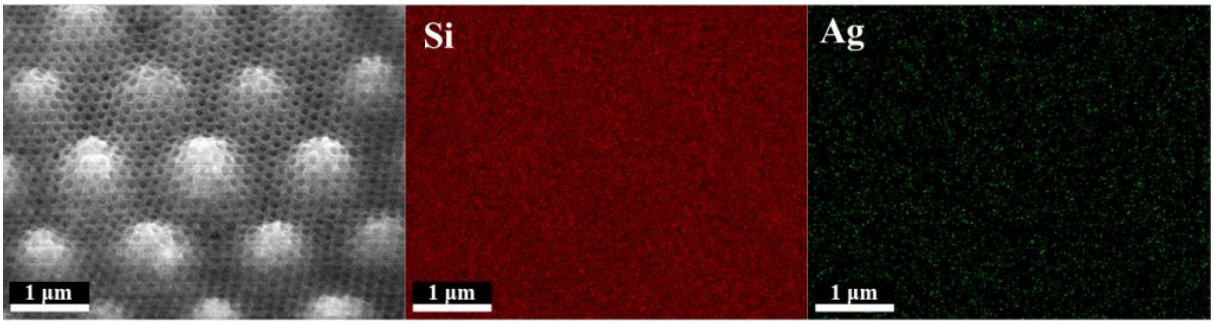

Figure S3. The corresponding EDS images of elements Si and Ag of Ag-NB/Si-P.

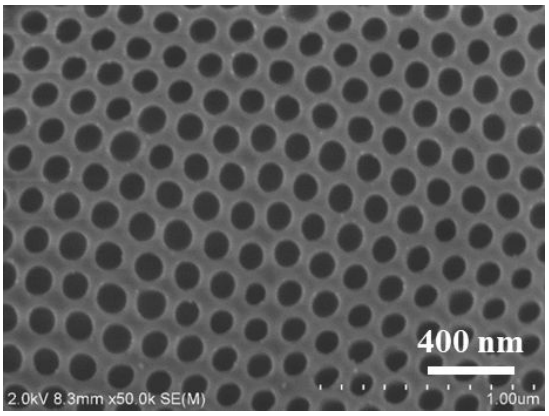

Figure S4. SEM image of the Ag-NB/Si-F substrate.

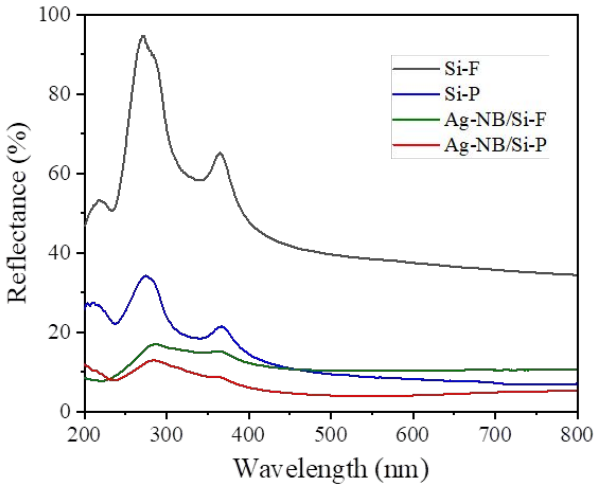

Figure S5. Reflectance spectra of Si-F, Si-P, Ag-NB/Si-F and Ag-NB/Si-P.

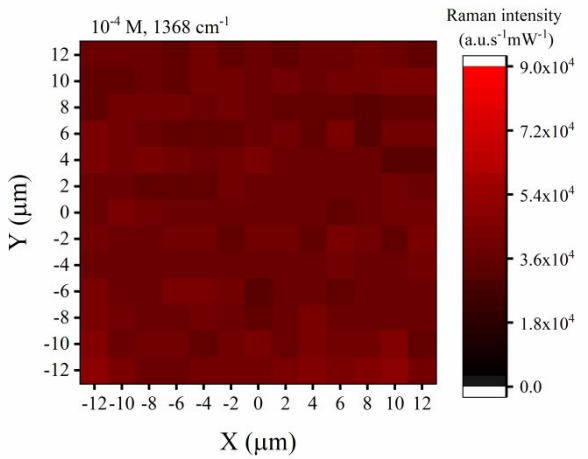

Figure S6. The SERS mapping of R6G on Ag-NB/Si-P over a large area of 26 × 26 μm^2 at 1368 cm^{-1}.

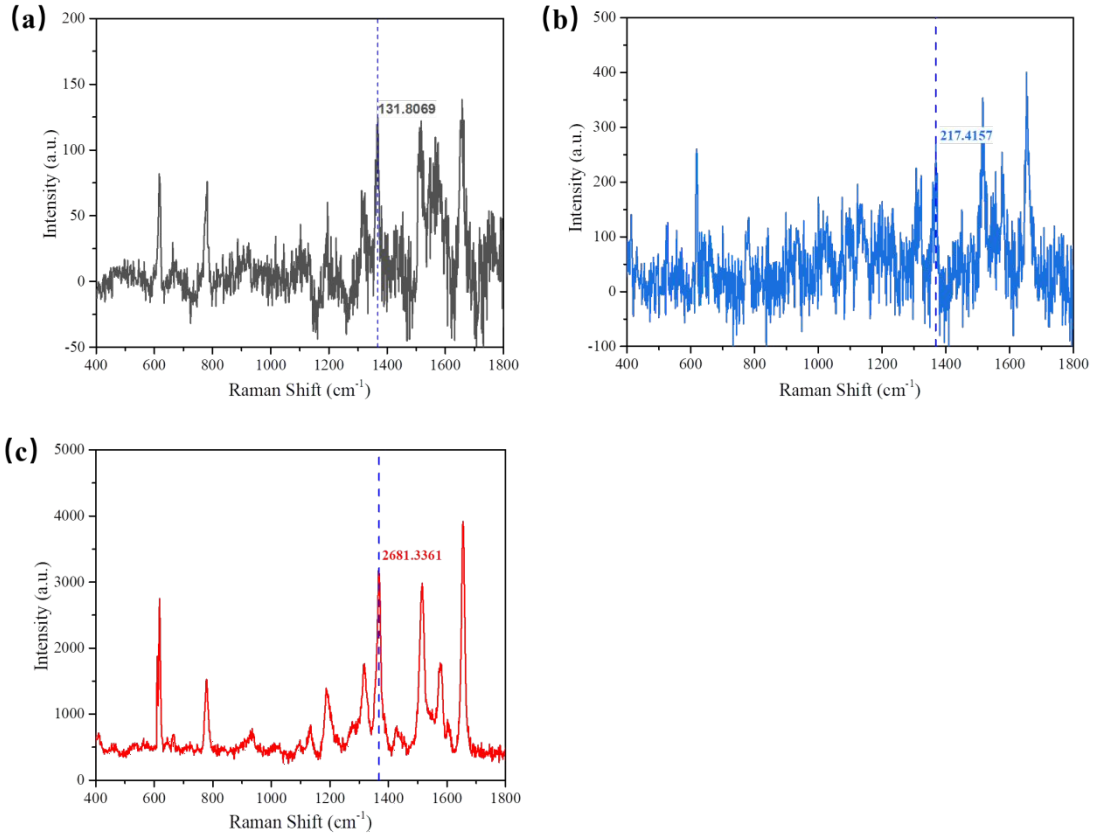

Figure S7. Raman spectra of (a) R6G (10^{-1} M) solutions on the surface of Si wafer, (b) R6G (10^{-9} M) solutions on the Ag-NB/Si-F substrate and (c) R6G (10^{-9} M) solutions on the Ag-NB/Si-P substrate.