# Electronic Supplementary Information

# Multiplex bioassays Encoded by photonic crystal and SERS nanotags

Bing Liu,[a,b] Xiangwei Zhao,[*a,b] Wen Jiang,[a,b] Degang Fu,[*ab] and Zhongze Gu[*a,b]

*Corresponding author: Xiangwei Zhao, E-mail: xwzhao@seu.edu.cn; Degang Fu, E-mail: fudegang@seu.edu.cn; Zhongze Gu, E-mail: gu@seu.edu.cn.

[a] State Key Laboratory of Bioelectronics, School of Biological Science and Medical Engineering, Southeast University, Nanjing 210096, China.

[b] Laboratory of Environment and biosafety, Research Institute of Southeast University in Suzhou, Suzhou 215123, China.

## 1. Fabrication of silica photonic crystal beads (PCBs)

An aqueous suspension containing mono-disperse silica nanoparticles (15 w/v %) with different diameters was used as the dispersed phase, with silicone oil (KF 96-10CSt, Shin-Etsu Chemical, Japan) as the continuous phase. In the process of synthesis, owing to the different speed of the two phases in the microfluidic channel, the aqueous silica suspension was broken into mono-disperse droplets by the oil flows and then the silica nanoparticles were self-assembled into ordered lattices when the droplets were heated at 70 ℃ overnight. After solidification at 100 ℃ for 2 h, the silica PCBs were thoroughly rinsed by hexane to remove the silicon oil, and sintered at 700 ℃ for 3 h to improve the mechanical strength of the beads.

## 2. Synthesis of gold nanoparticles (GNPs)

A 100 mL sample of aqueous $HAuCl_4$ (0.01 % w/w) was boiled under vigorous stirring and then 0.75 mL of 1 % (w/w) aqueous sodium citrate was rapidly added. Finally, the mixture was allowed to boil for 10 min until the color did not change.

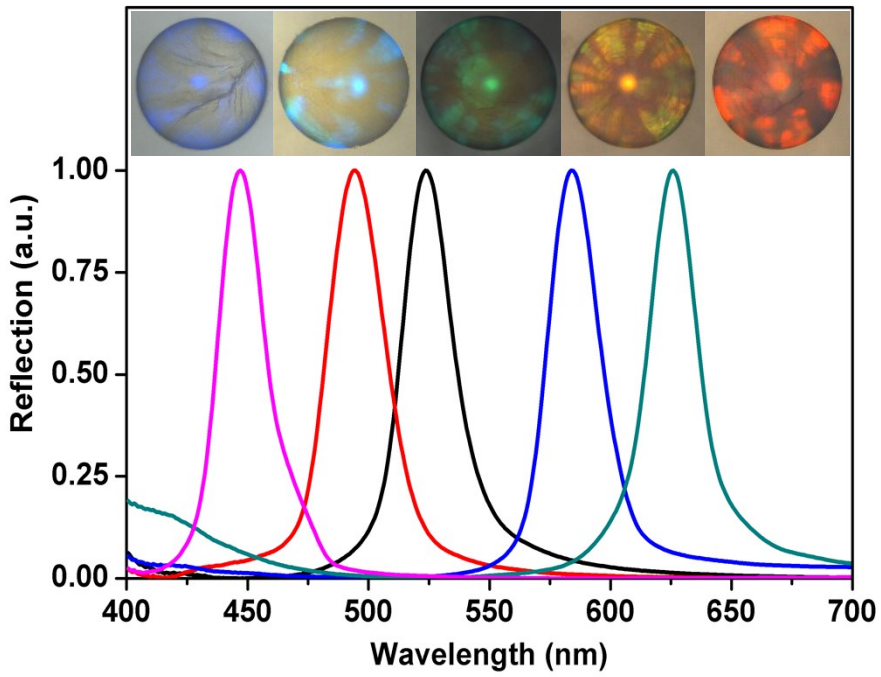


**Fig. S1** Reflection spectra of five silica PCBs. The reflection spectra were 447, 494, 524, 583 and 625 nm from left to right. Bright-field microscopy images of five silica PCBs.

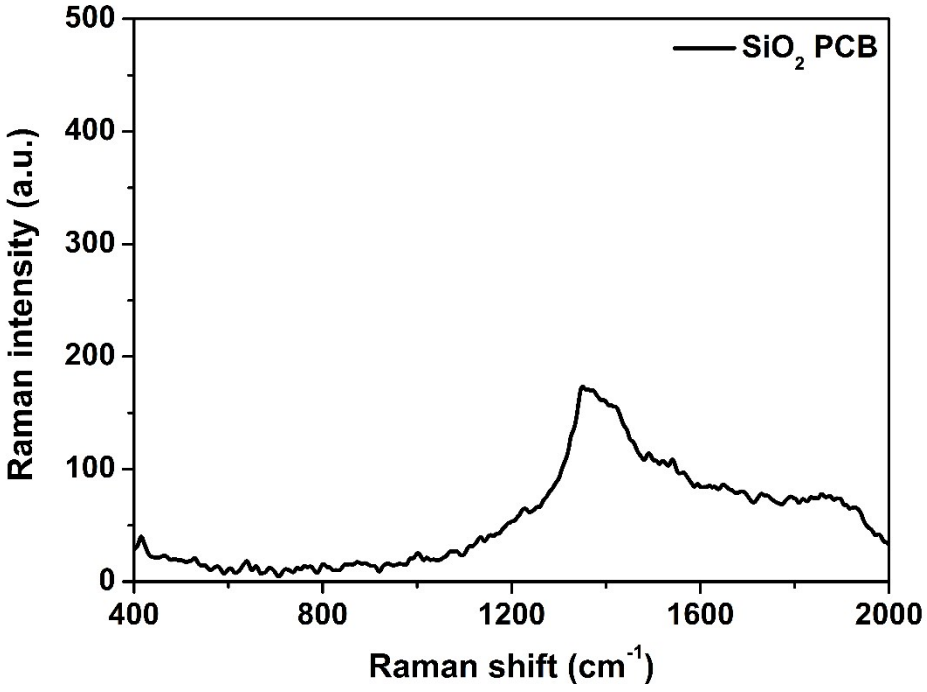


**Fig. S2** Raman spectrum of silica PCB.

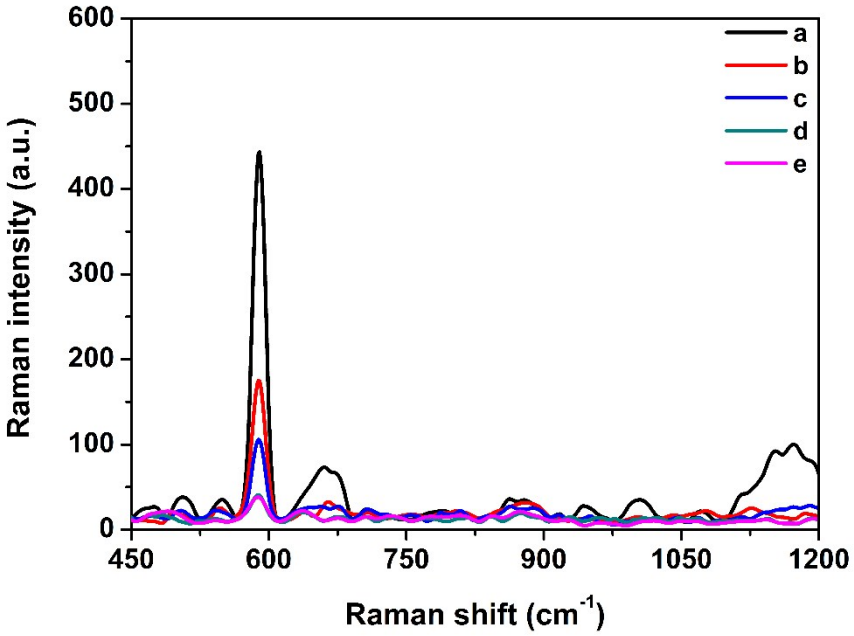


**Fig. S3** Raman spectra of silica PCB with different washing times when the concentration of antigen is 0 pg/mL. (a) 0 time, (b) one time, (c) two times, (d) three times, (e) four times.

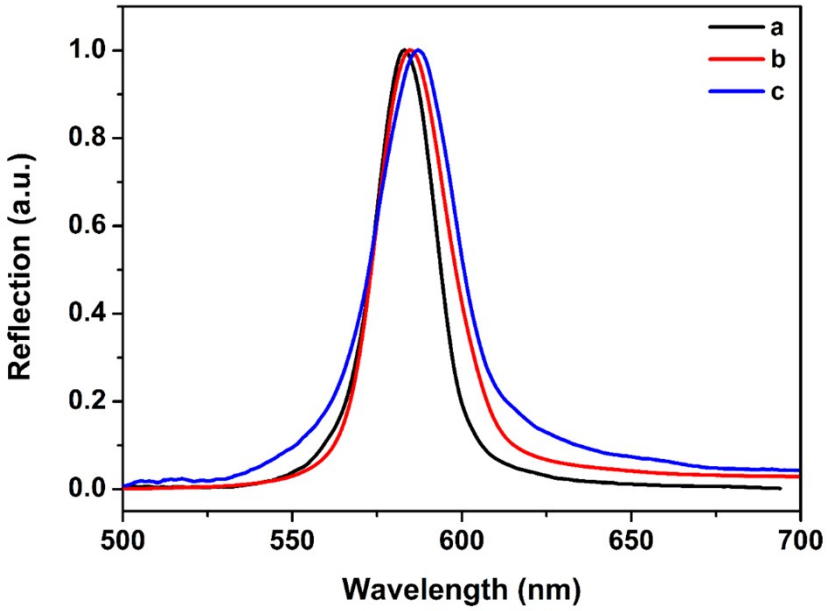


**Fig. S4** Reflection spectra of PCB (a), PCB after reaction with 100 μg/mL antigen (b), PCB after SERS nanotags reaction (c).

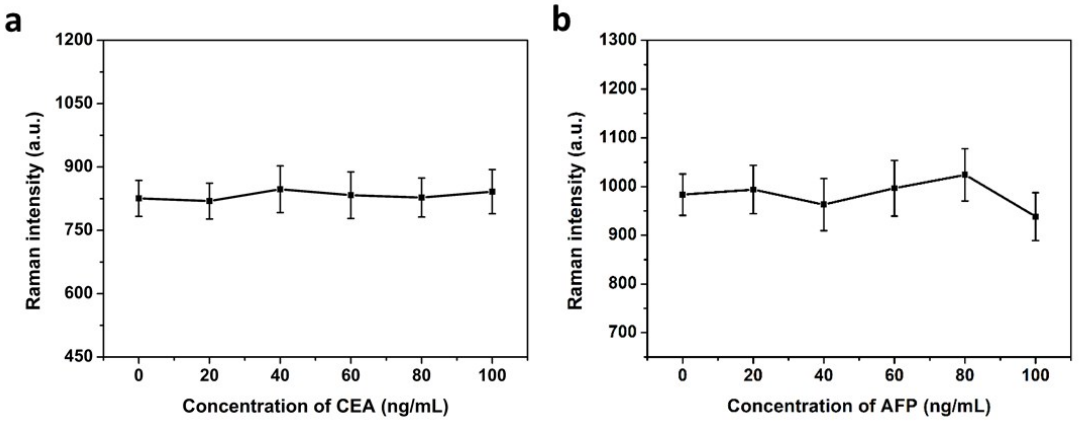


**Fig. S5** Cross-reactivity of another interfering analyte to AFP (a) and CEA (b) antibodies in the presence of 20 ng/mL AFP and CEA, respectively. Error bar is calculated with 5 repeats.

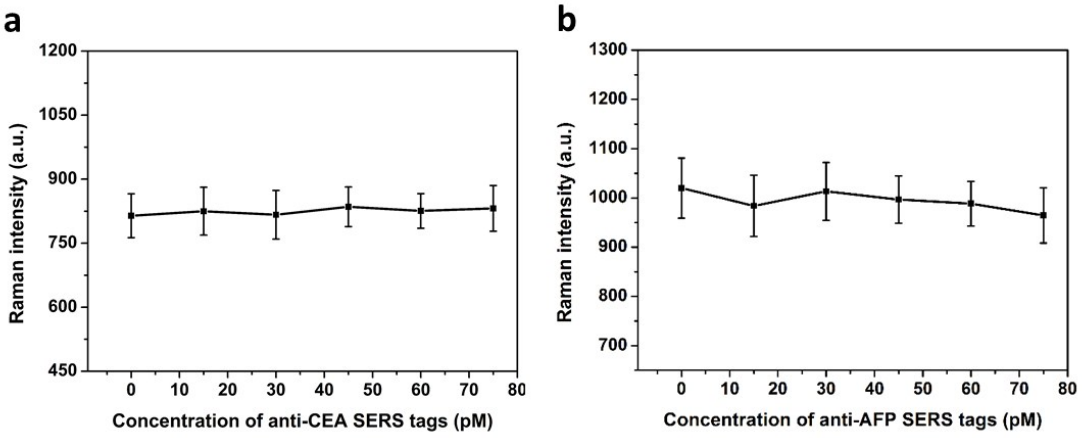


**Fig. S6** Cross-reactivity of another interfering SERS nantags to AFP (a) and CEA (b) antibodies in the presence of 20 ng/mL AFP and CEA, respectively. Error bar is calculated with 5 repeats.