# Supporting Information

# Enhancing the Plasmonic Component of Photonic-Plasmonic Resonances in Self-Assembled Dielectric Spheres on Ag

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## EXPERIMENTAL METHODS

*Materials:* Sodium dodecyl sulfate (97 %) was purchased from JUNSEI. PS sphere (LB1; *D* = 92.8 ± 18.0 nm, LB3; *D* = 285.2 ± 6.5 nm, and LB5; *D* = 386.2 ± 6.1 nm) emulsions were purchased from Sigma Aldrich. Silicon wafers were obtained from TASCO, and cleaned by sonicating and rinsing sequentially in acetone, isopropyl alcohol (IPA) and distilled water. All thin film depositions (Ge, Ag, $TiO_2$) were conducted with an e-beam evaporator (ULVAC). For controlled injection of PS sphere emulsion into water, a single syringe pump (Dongbang-hightech) with a 1/32" diameter Teflon tube was used.

*Characterization:* Spatial analysis was performed with a field-emission scanning electron microscope (JSM-6700F, JEOL). Reflection spectra from samples were obtained with an integrating sphere (Labsphere Inc.) fiber-coupled to a spectrometer (Ocean optics).

*FDTD simulation:* A commercial software (Lumerical Inc.) was used to simulate the fields and reflection spectra from the PS sphere arrays. The refractive index of PS spheres was found from literature[1] while those for Ag, Ge and $TiO_2$ were found from CRC[2], Palik[3], and ellipsometry, respectively. The mesh size was scaled to accommodate the PS sphere size. Symmetric boundary conditions were used in the transverse directions to reduce simulation time, while perfectly matched layers were used for the boundaries in the depth direction. A TM or TE-polarized plane wave was used as the source.

**SUPPORTING FIGURES**

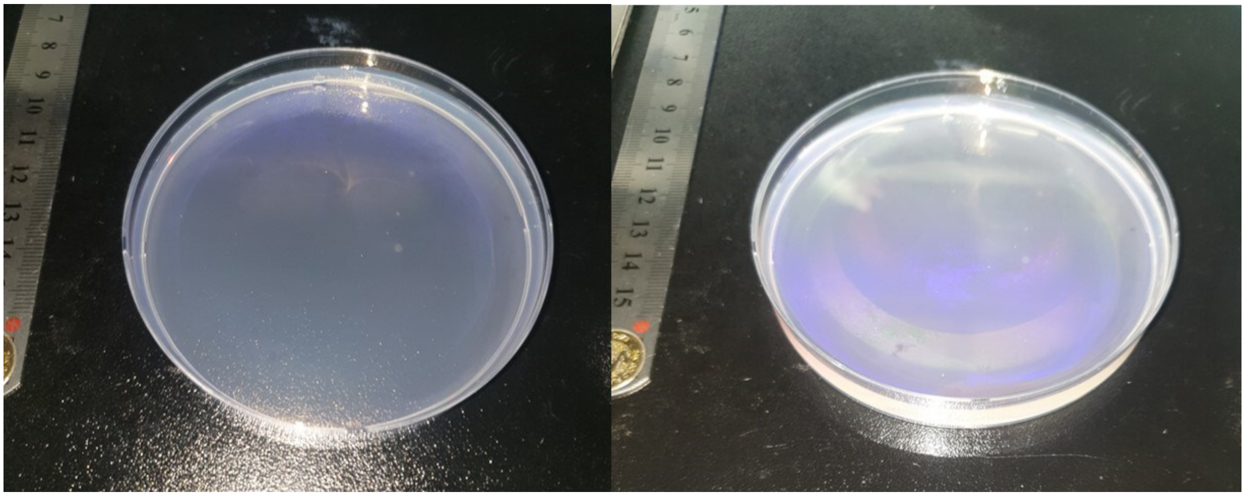


**Figure S1.** Self-assembled PS sphere array formed on water-air interface in a 3.5-inch-diameter sized petri dish.

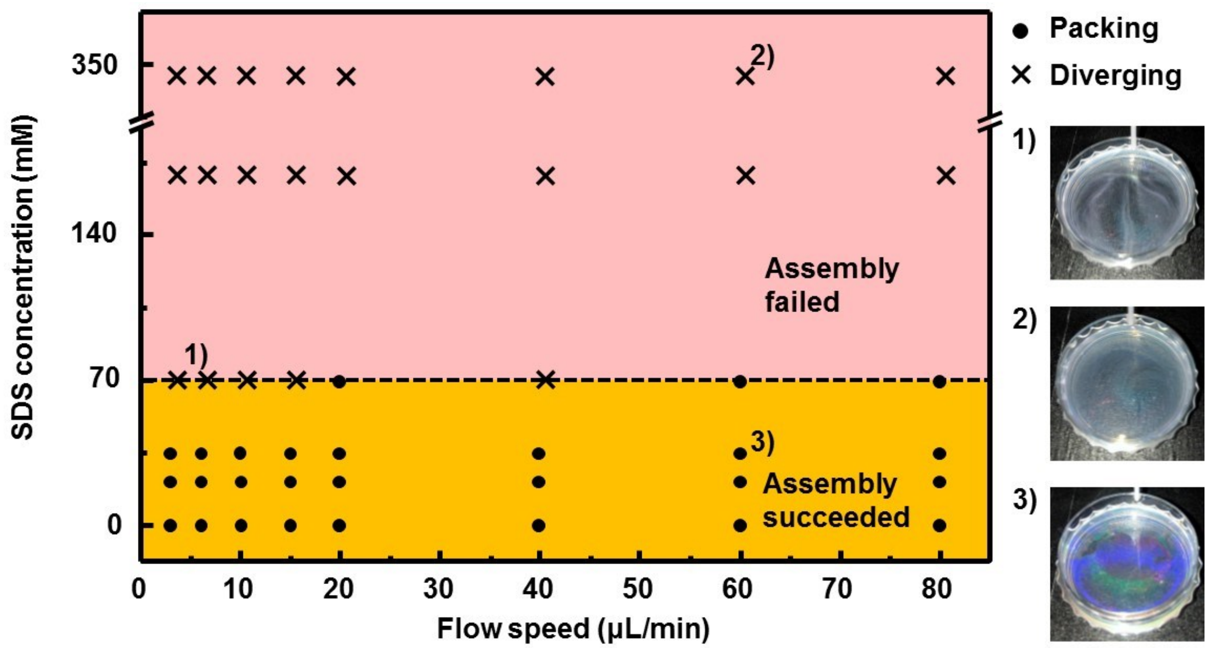



**Figure S2.** Experimental conditions for forming a continuous close-packed PS sphere monolayer on water. Failure and success of self-assembly for different SDS concentration and emulsion injection flow speed are indicated by ● and ×.

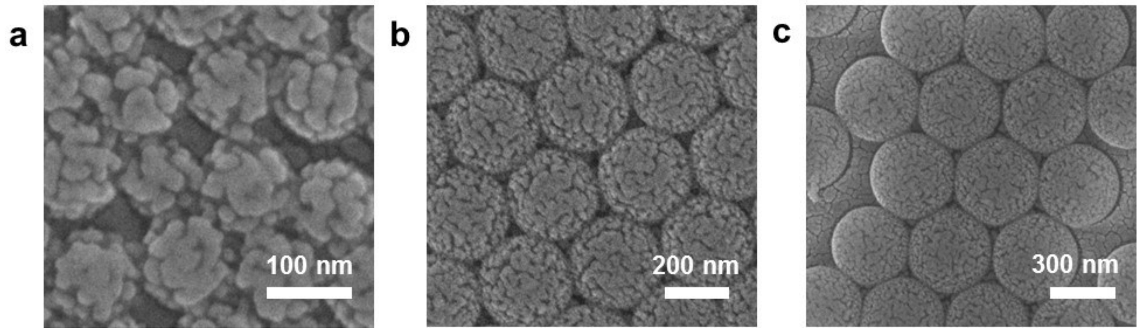



**Figure S3.** SEM images of Ag (10 nm) deposited on a PS sphere array without a Ge wetting layer. Sphere size is (a) 98 nm (b) 285 nm and (c) 386 nm.

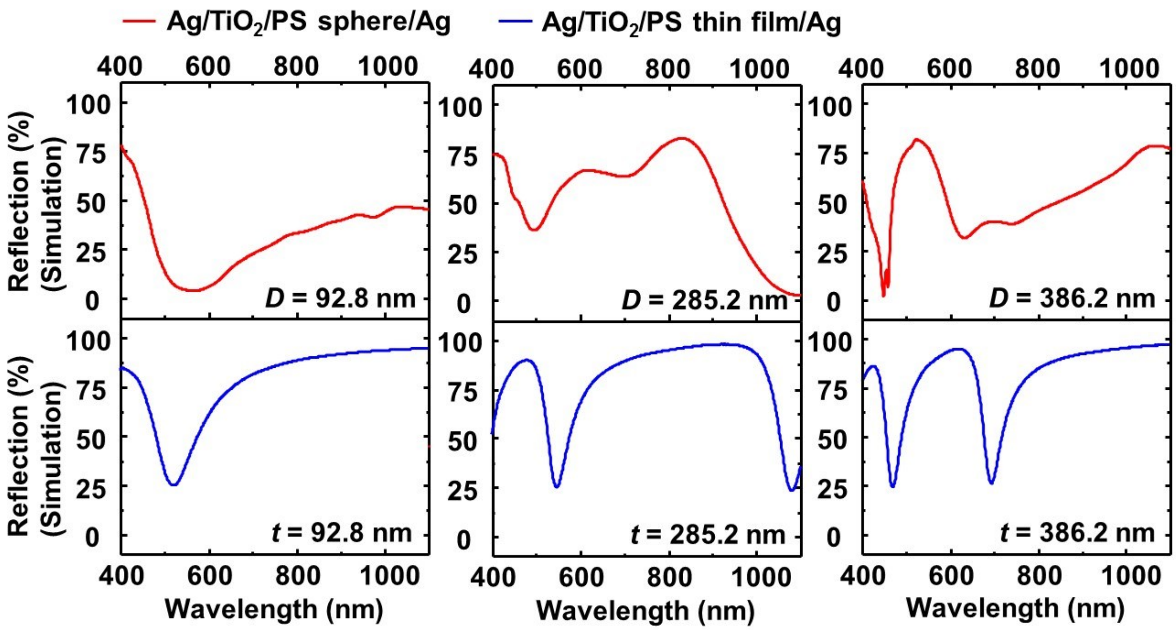
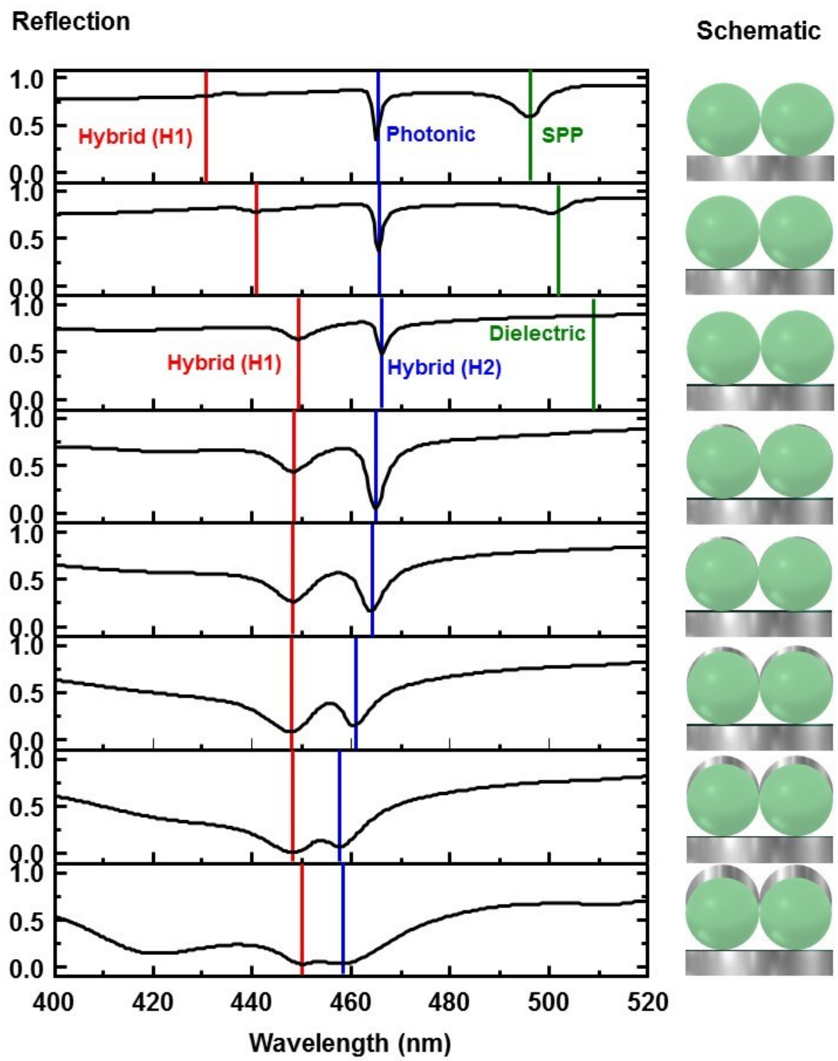



**Figure S4.** Simulated reflection spectra of Ag/$TiO_2$/PS sphere/Ag and Ag/$TiO_2$/PS thin film/Ag films for different sphere sizes and film thicknesses, respectively. The PS thin film thickness is equal to the diameter of the PS sphere. An effective refractive index is used for the PS thin film. The effective refractive index takes into account the voids in the sphere array.




| $TiO_2$ coating | Ag coating |
|---|---|
| 0 | 0 |
| 3 | 0 |
| 10 | 0 |
| 10 | 1 |
| 10 | 3 |
| 10 | 6 |
| 10 | 10 |
| 10 | 20 |

(Dimension : (nm))

**Figure S5.** Simulated reflection spectra of Ag/$TiO_2$/PS sphere/Ag film with different $TiO_2$ and Ag-coating thicknesses.

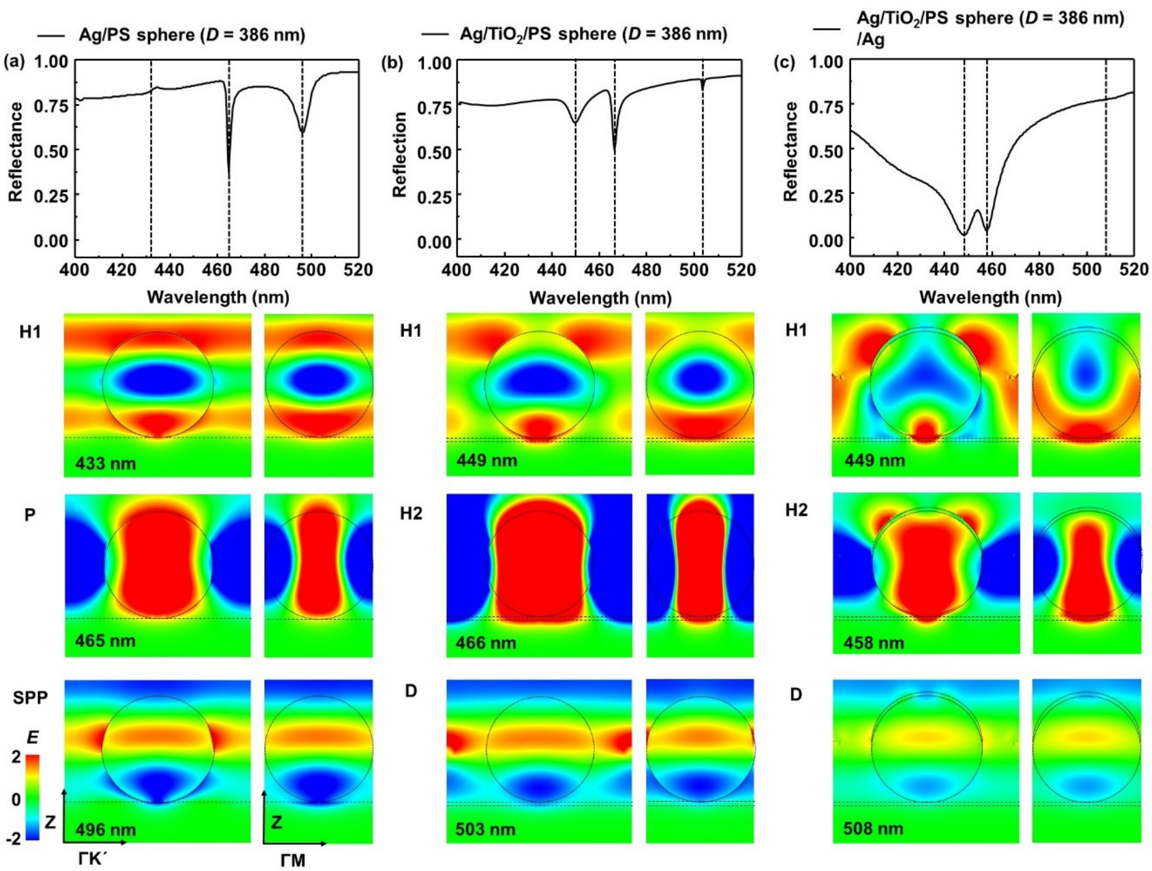



**Figure S6.** Simulated reflection spectra and electric field profiles from TE excitation of (a) bare PS sphere array on bare Ag, (b) bare PS sphere array on Ag/$TiO_2$ and (c) Ag-coated PS sphere array on Ag/$TiO_2$. The PS sphere size is 386 nm. Mode notations are defined as SPP: surface plasmon polariton, D: dielectric, P: photonic, H1: D hybridized with SPP and H2: P hybridized with SPP.

## REFERENCES


1. X. Ma, J. Q. Lu, R. S. Brock, K. M. Jacobs, P. Yang and X.-H. Hu, *Phys. Med. Biol.*, 2003, **48**, 4165.
2. D. Lide and H. Frederikse, Boca Raton, *CRC Handbook of Chemistry and Physics, 74th Edition,* CRC Press, 1993.
3. D. Edwards, *Handbook of Optical Constants of Solids*. Academic Press, 1998.