*Electronic Supplementary Information for*

# Robust Plasmonic Sensors Based on Hybrid Nanostructures with Facile Tunability

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## Supporting Figures

**Figure S1. C.-J. Heo et al.**

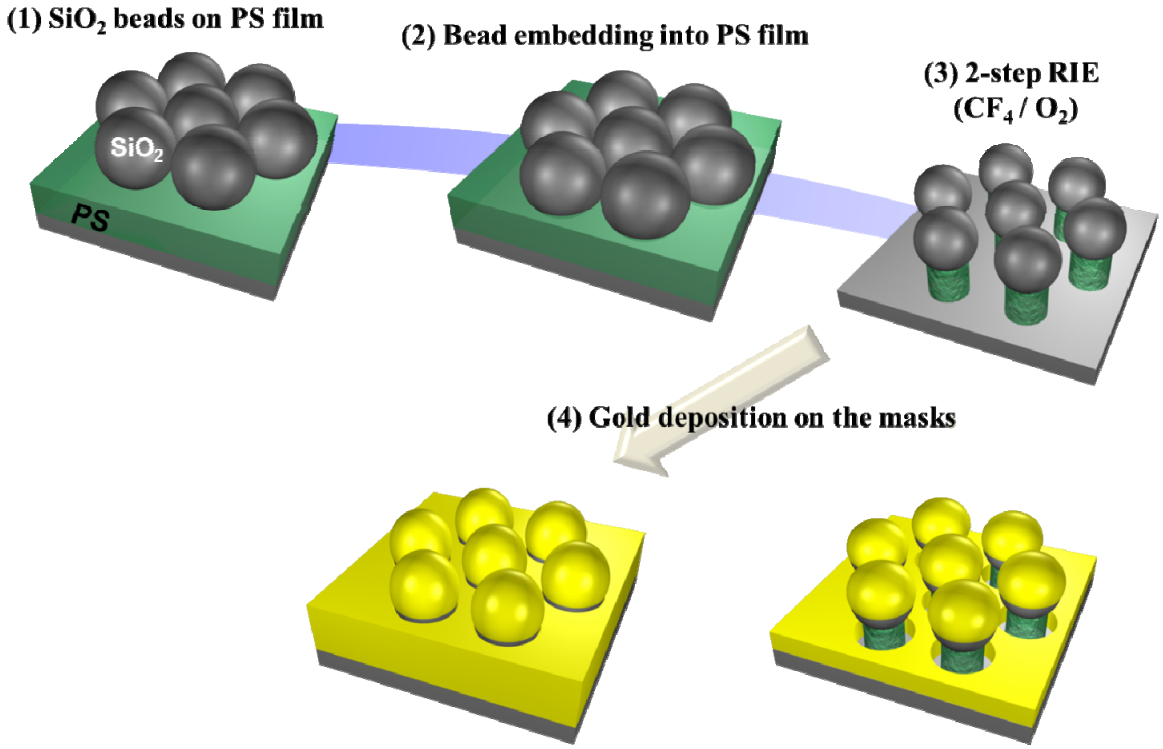


**Figure S1 Fabrication procedures for preparing gold nanoforest.** (1) Hexagonally ordered single layer of silica colloidal particles (diameter ~ 200 nm) are spin-coated onto the PS thin film, (2) silica nanoparticles are slightly embedded in the polymer thin film, (3) a two-step reactive ion etching process with $CF_4$ and $O_2$ is performed to reduce the particle size and to remove the underlying polystyrene layer, (4) gold thin film is deposited onto the composite mask arrays with highly directional e-beam evaporator system varying the deposition thickness.

**Figure S2. C.-J. Heo et al.**

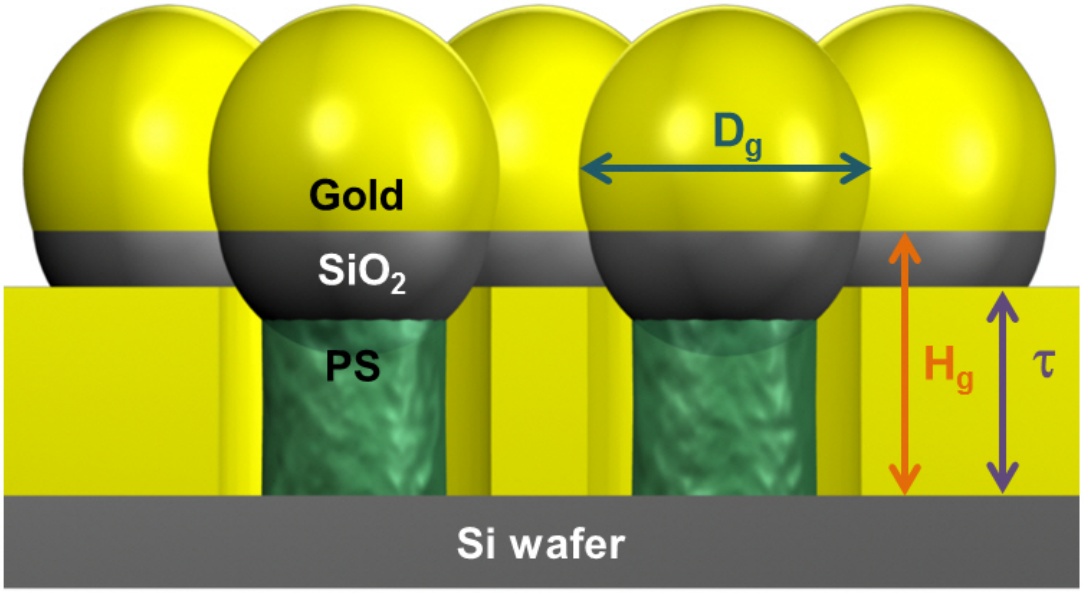


**Figure S2** Schematic diagram of gold nanoforest structure. Three important structural parameters ($D_g$, $H_g$, τ) which can be varied by changing lithographic conditions were defined.

**Figure S3. C.-J. Heo et al.**

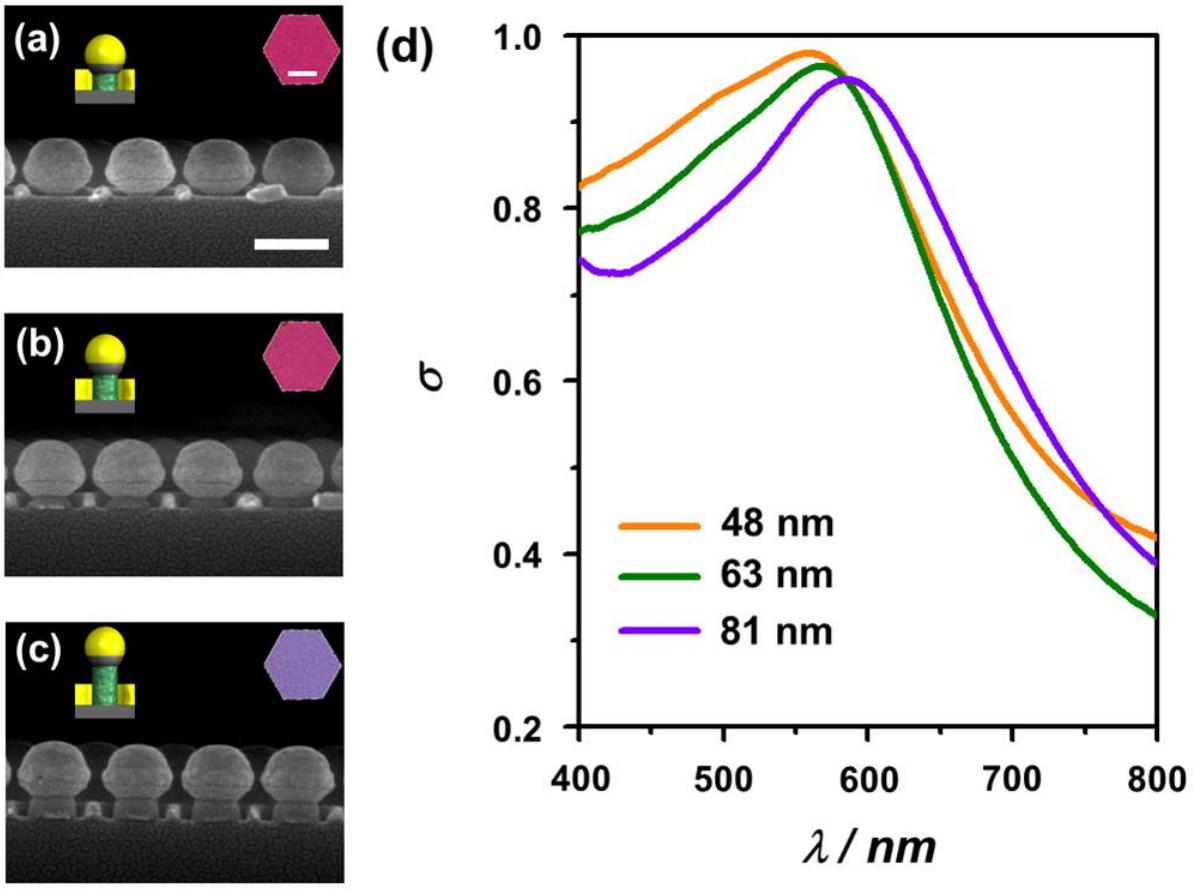


**Figure S3 Tuning of vertical structural size by varying height of polymer pillar.** (a-c) Cross-sectional SEM images of gold nanoforests with different $H_g$. Resulting $H_g$s are 48, 63 and 81 nm, respectively. Insets are optical microscope images of reflected colors from plasmonic substrate with gold nanoforests. Scale bars are 200 nm. Scale bars in insets are 20 μm. (d) Extinction spectra of nanoforests with different $H_g$ corresponding to structures of a-c. (Orange : a, 48 nm, green: b, 63 nm, purple: c, 81 nm)

**Figure S4 . C.-J. Heo et al.**

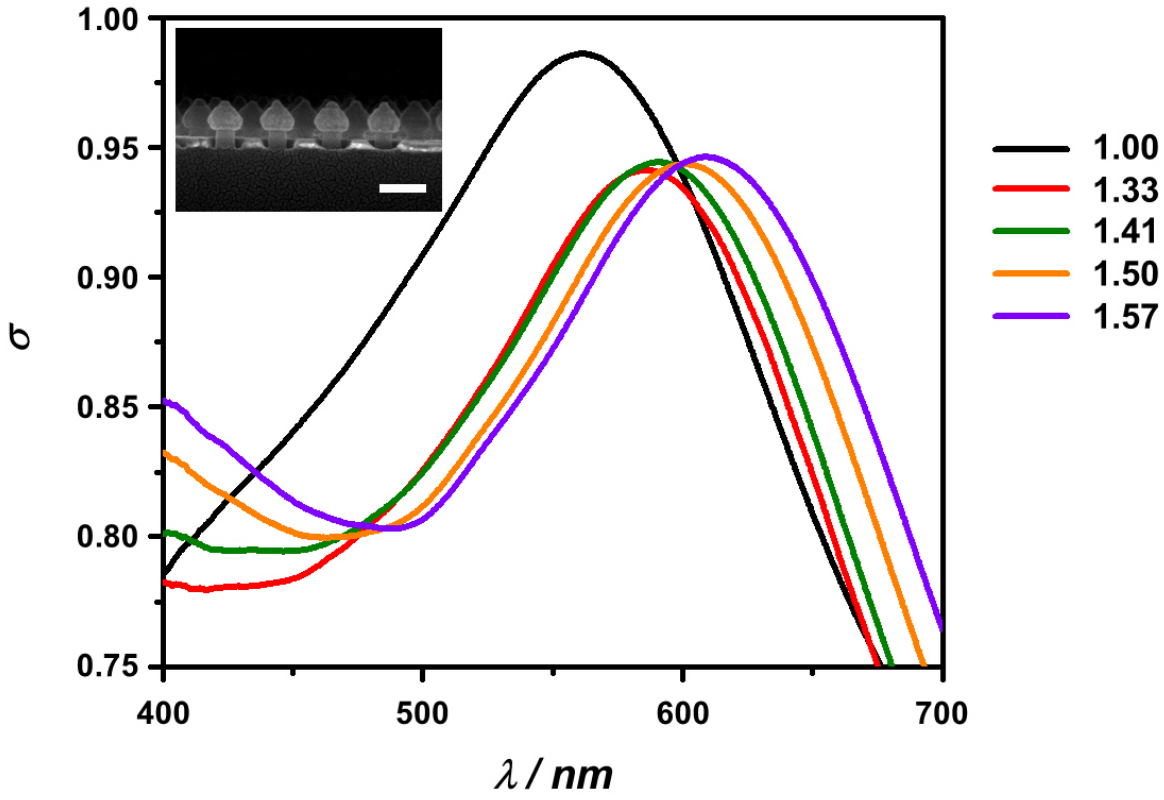


**Figure S4** Response of plasmonic properties of nanoforest with larger vertical gap to solvents. Reflectance spectra of nanoforest under various solvents. (1.00 : air, 1.33 : ethanol, 1.44 : hexadecane, 1.50 : toluene, 1.57 : 1,2,4-trichlorobenzene)

**Figure S5 . C.-J. Heo et al.**

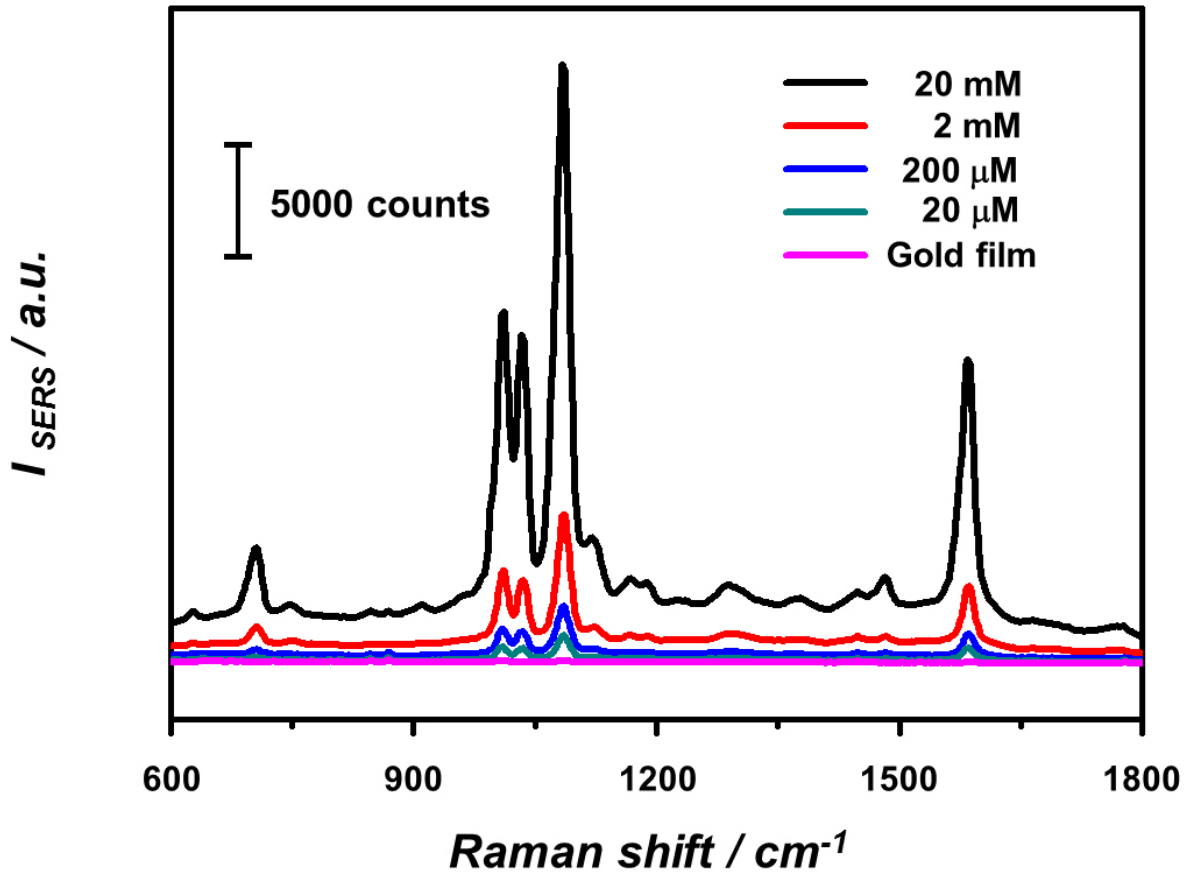


**Figure S5** SERS characterization of benzenethiol-immobilized on representative gold nanoforest by varying concentration of benzenthiol solution from 20 mM to 20 μM. As a purpose of comparison, flat gold film coated on Si wafer which was immersed on 20 mM benzenethiol solution for 6 hrs was characterized.

**Figure S6 . C.-J. Heo et al.**

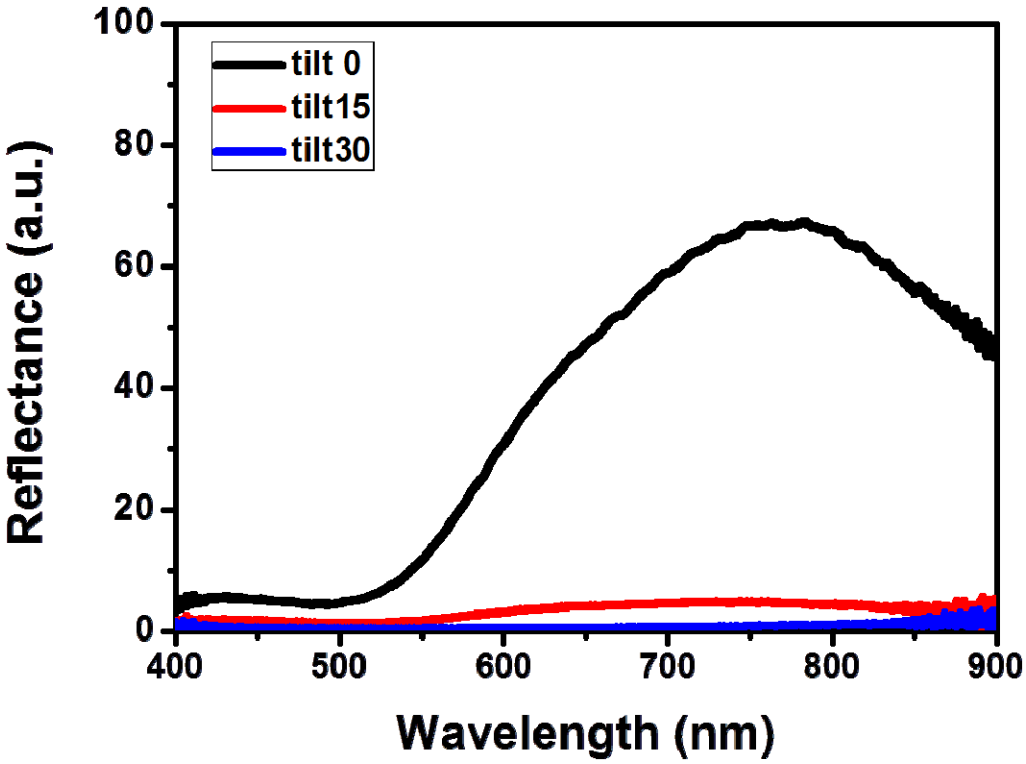


**Figure S6** Reflectance spectra of nanoforest with $H_g$= 80 nm, $D_g$= 191 nm and $\tau$= 20 nm at various angles (0°, 15°, 30°).

**Figure S7 . C.-J. Heo et al.**

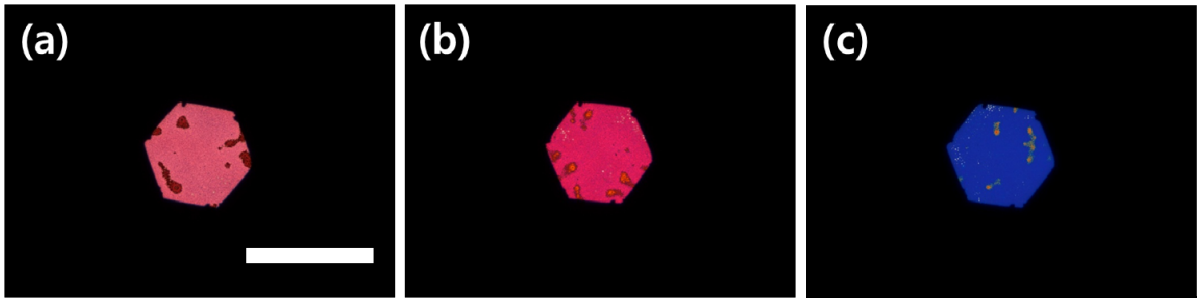


**Figure S7** Original optical microscope images of the reflected colors from plasmonic substrate with gold nanoforests which correspond to OM images of Fig2a-c. Hexagonal shapes Scale bars are 200 μm.