Supplementary Information

for

Nanoporous Au/SnO/Ag Heterogeneous Films for Ultrahigh and Uniform Surface-enhanced Raman Scattering

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Figure S1. (a) Typical high-resolution SEM image and (b) EDS of NP Au films dealloyed in concentrated HNO₃ solution for 10 hours. The Cu peaks are from the copper sample holders.
Figure S2. (a) Top-view SEM image and (b) EDS of NP Au films implanted with SnO nanoparticles by electroless plating in 0.2 mM SnCl₂ solution for 120 minutes.
**Figure S3.** Representative top-view SEM image of NP Au/Ag films without SnO incorporation in 0 mM SnCl$_2$. 
Figure S4. UV-Visible extinction spectra for NP Au, NP Au/SnO, NP Au/SnO/Ag and NP AuAg films. Here NP Au has a characteristic length of ~45 nm. NP Au/SnO is fabricated by plating SnO nanoparticles on the NP Au films in 1 mM SnCl$_2$ aqueous solution for 2 hours. NP Au/SnO/Ag is prepared by electroless plating Ag shell onto NP Au/SnO film for 30 minutes. NP AuAg is synthesized by electroless plating Ag shell onto NP Au film for 30 minutes.
Figure S5. Surface-enhanced Raman scattering spectra of R6G molecules ($10^{-7}$ M) on SERS-active NP Au and NP Au/SnO films. The laser wavelength is 532 nm.
Figure S6. Ag-plating-time dependence of normalized SERS enhancements of NP Au/SnO/Ag films decorated with SnO nanoparticles in 0, 0.2 and 1 mM SnCl₂ solutions relative to bare NP Au or NP Au/SnO (t = 0) [I(t)/I₀] at the Raman bands of (a) 1363 cm⁻¹ and (b) 1182 cm⁻¹ of R6G molecule.
Figure S7. SERS spectra of R6G adsorbed on NP Au/Ag films without SnO incorporation that were fabricated by electroless plating Ag shell onto NP Au films with the characteristic length of ~45 nm for 0, 2, 8, 20, 30 min.
Figure S8. SERS spectra of $10^{-6}$ M R6G molecule adsorbed on SnO/Ag films. The SERS intensity of each spectrum collected at different spots is dramatically different from each other, illustrating that the SnO/Ag film exhibits low and nonuniform SERS enhancement.
Figure S9. SERS spectra of $10^{-7}$ M R6G molecule adsorbed on NP Au/Fe$_3$O$_4$/Ag films. The SERS enhancement of NP Au/Fe$_3$O$_4$/Ag films increases with the increasing concentrations of FeCl$_3$ and FeCl$_2$ from 1 and 0.5 mM to 5 and 2.5 mM, respectively.