Template-Assisted Plasmonic Nanogap-Shells for Highly Enhanced Biomarker Detection

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Figure S1. Ultraviolet/visible/NIR extinction spectra of Ag nanogap shells (black line) and Ag silica (red line) at the same concentration (0.06 mg/mL, based on silica NPs). The extinction coefficients of Ag NGS and Ag silica at 785 nm were obtained to 4.55×10^{10} cm^{-1} M^{-1} and 0 cm^{-1} M^{-1}, respectively.
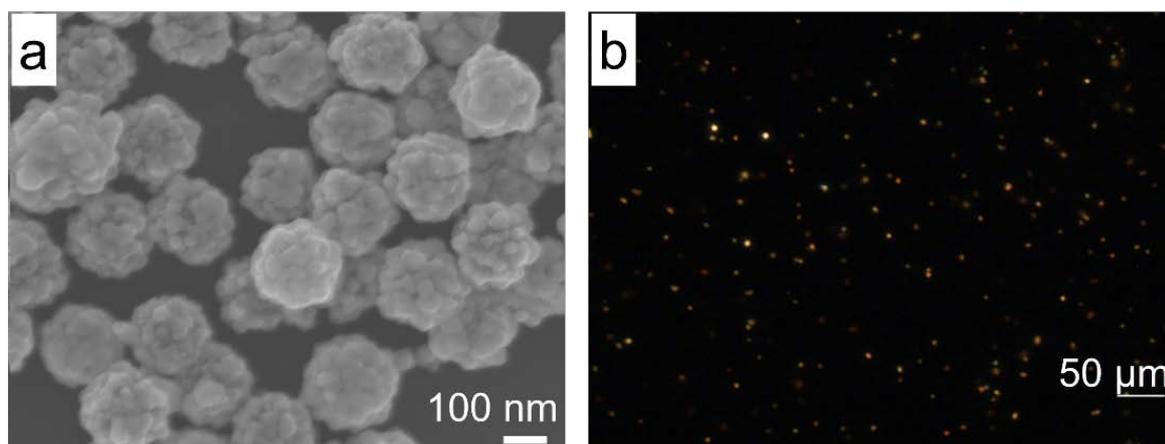
Figure S2. (a) Field emission-SEM image of Ag NGSs and (b) dark-filed microscopic image of dispersed Ag NGSs on a glass slide
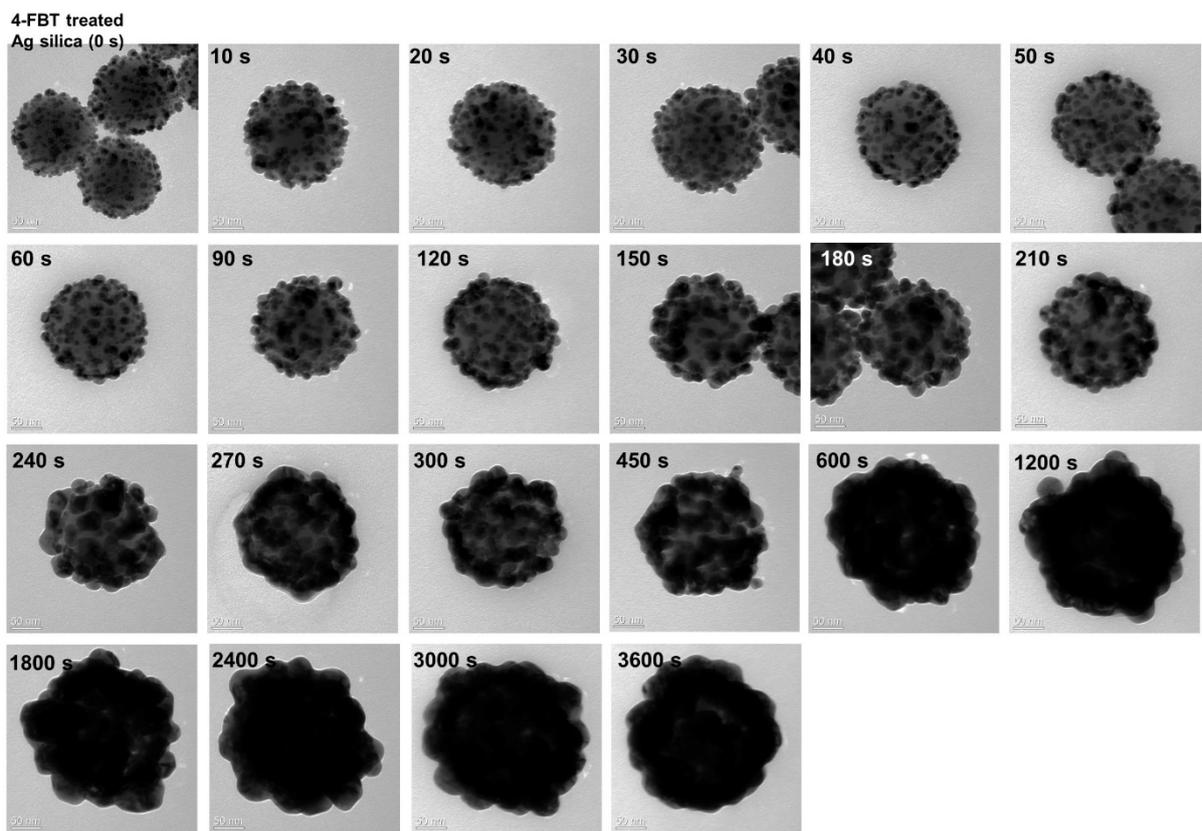
Figure S3. TEM images of Ag NGS particles taken during the Ag shelling process to investigate the mechanism and kinetics of nanogap shell formation
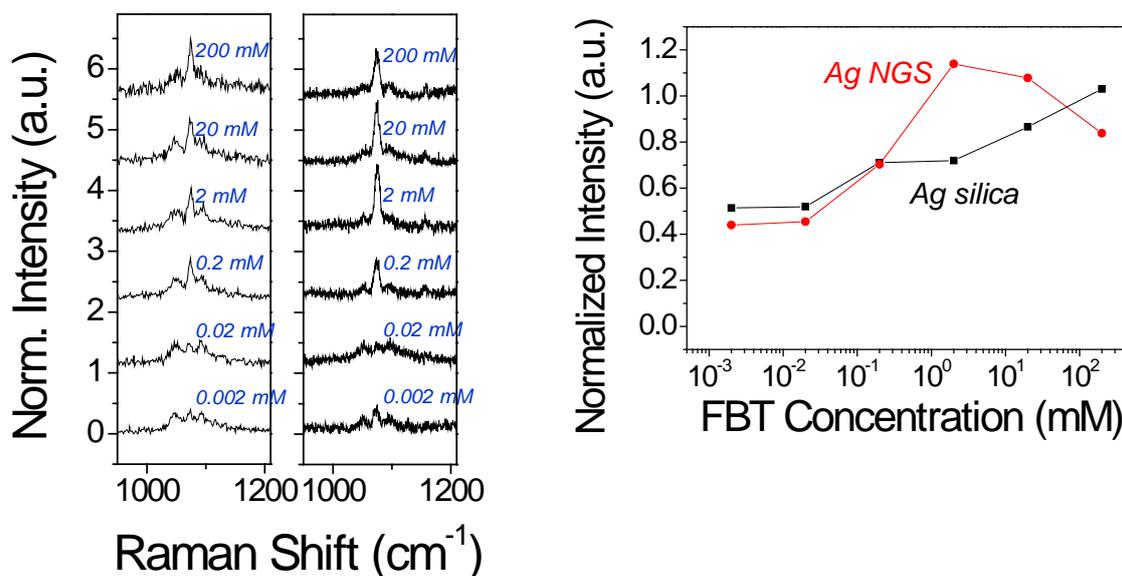
Figure S4. SERS spectra and normalized SERS signal intensities of Ag silica and Ag NGS particles after 4-FBT labeling. (a) SERS spectra of Ag silica and Ag NGS particles labeled in solution with various concentrations of 4-FBT (0.002–200 mM). SERS spectra were obtained using a 532-nm laser with 1 mW power (for Ag silica) or a 785-nm laser with 5.4 mW power (for Ag NGSs). The laser line was selected for the corresponding localized surface plasmon resonance of each type of particles. (b) Normalized SERS signal intensities of Ag silica and Ag NGS particles at 1075 cm^{-1}. Each signal was normalized by dividing by the ethanol peak intensity at 886 cm^{-1}.

i) BT ii) 4-IBT iii) mPEG-SH

iv) 4-CBT v) 4-FBT vi) 4-BBT

vii) 2-CBT viii) 2-FBT

ix) 4-ATP x) MBA
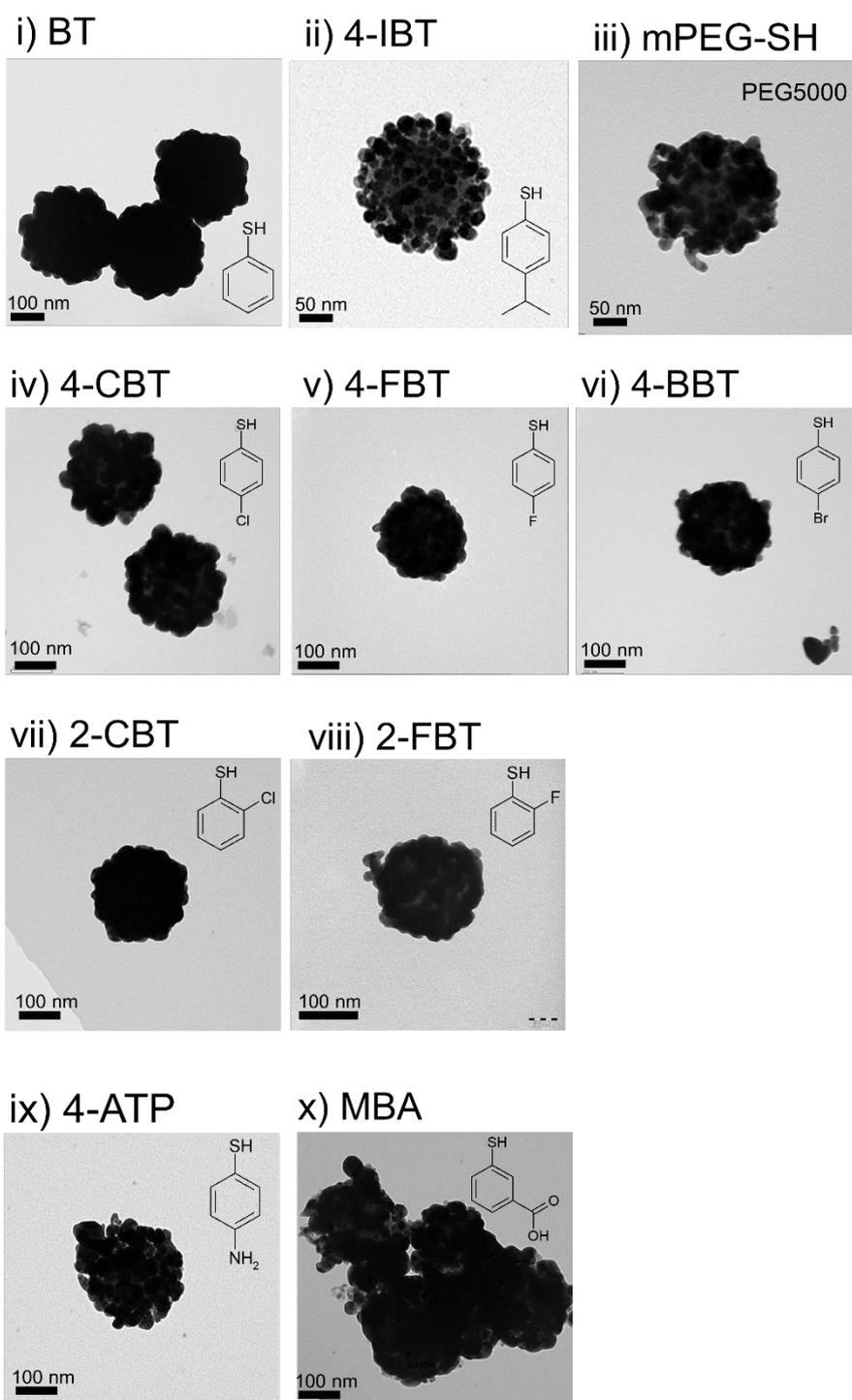
Figure S5. TEM images of various Raman label compound (RLC)-labeled Ag NGSs showing the formation and surface morphology of Ag NGSs. TEM images were taken to investigate the effects of different RLCs.
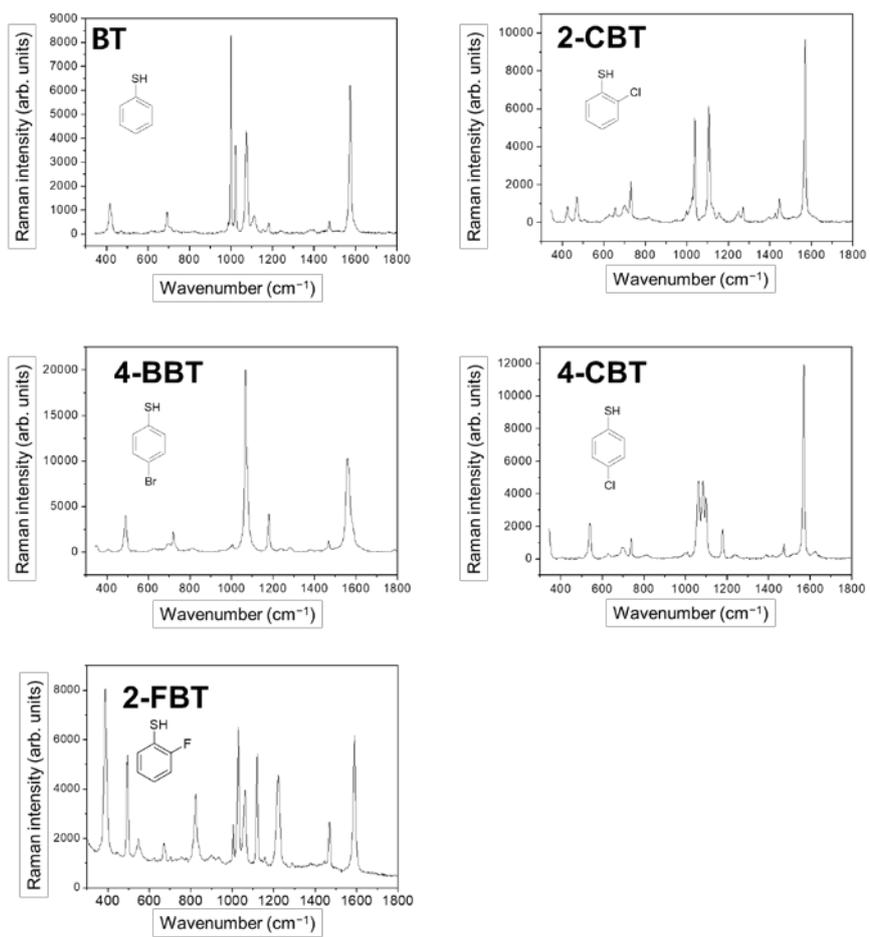
Figure S6. SERS spectra of BT, 2-CBT, 4-BBT, 4-CBT, and 2-FBT labeled Ag NGSs.
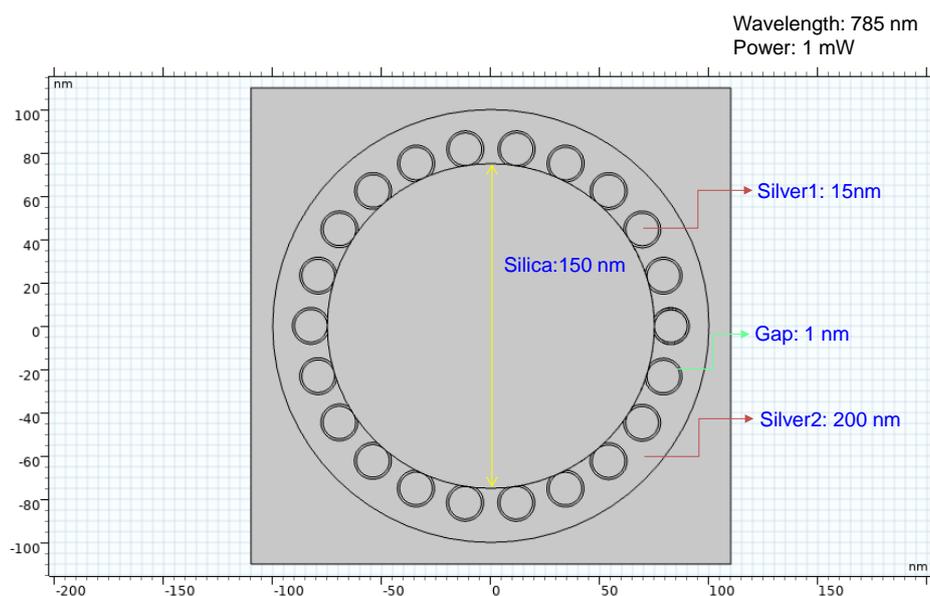
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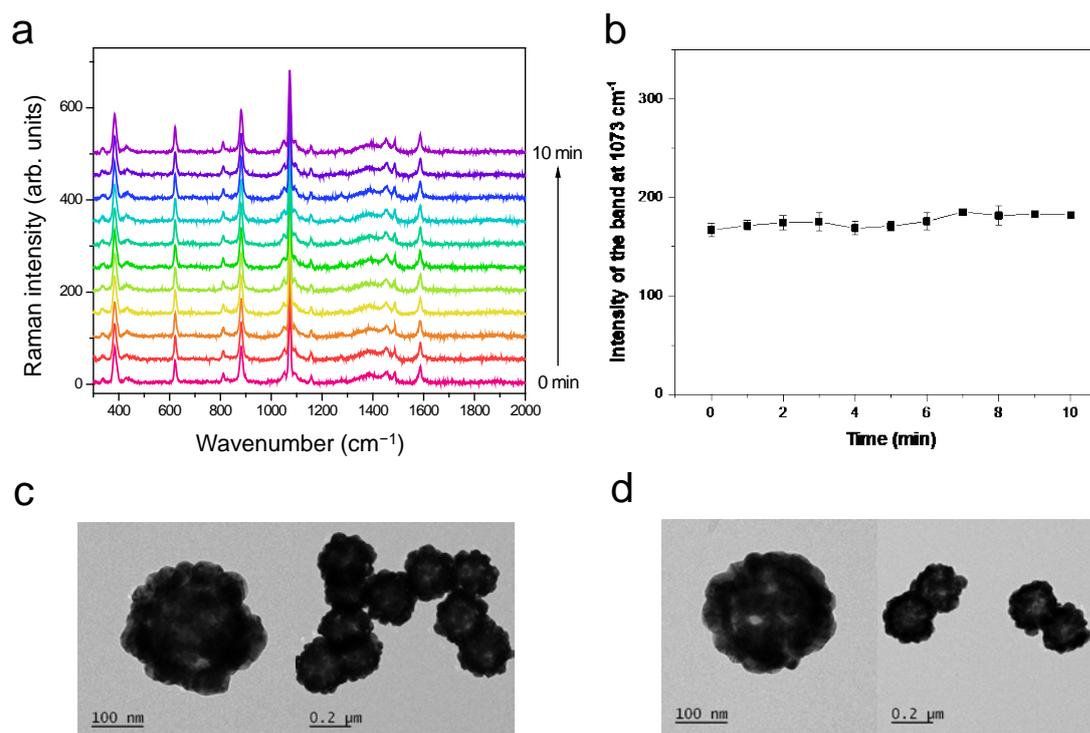
Figure S8. Photostability of Ag NGS particles. (a) Raman spectra of Ag NGS colloidal solution with continuous laser exposure for 10 minutes. The colloidal concentration of Ag NGSs was 0.1 mg/mL, and the Raman signals were collected from the sample in a capillary using 10× objective lens. Each spectrum was obtained with a 785-nm photo-excitation laser power of 6.53 mW and an 8-s acquisition time. (b) Signal intensity changes at 1073 cm^{-1} band during the Raman measurement in (a). TEM images of Ag NGSs (c) before the laser exposure and (d) after 10-minutes laser exposure.
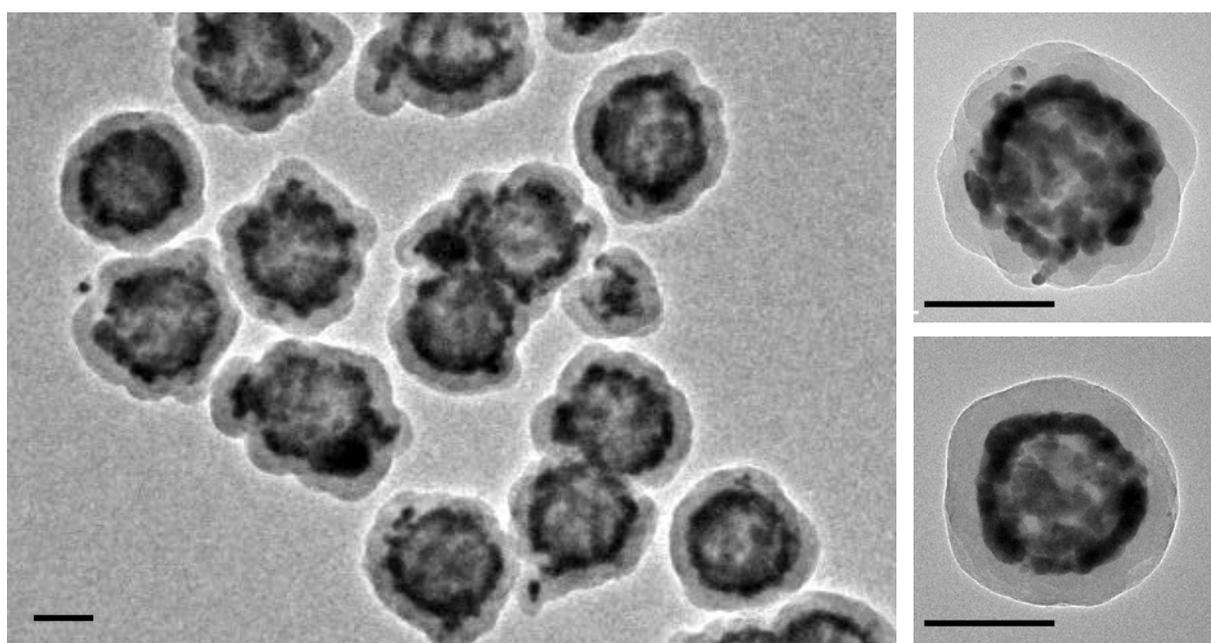
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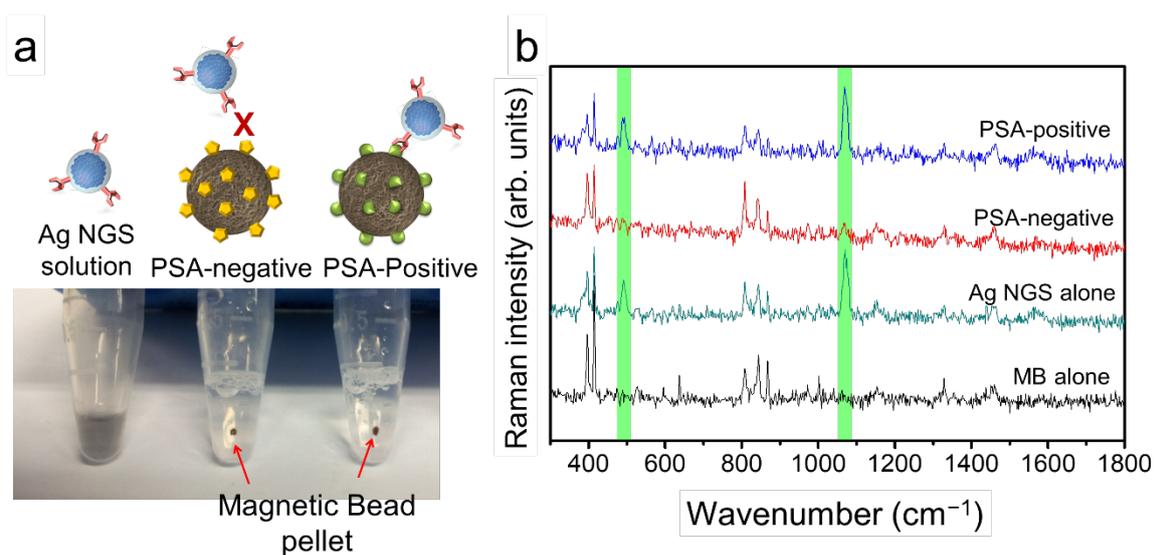
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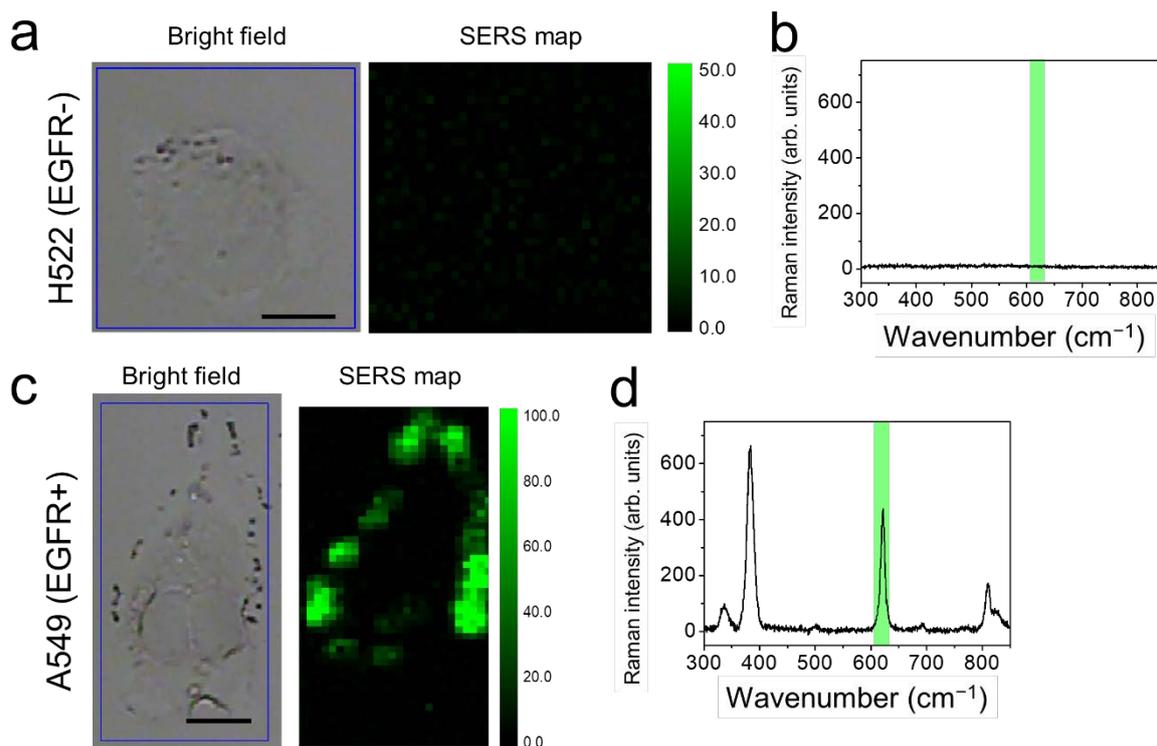
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