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Supporting information

FDTD Analysis of Hotspot-Enabling Hybrid Nanohole-Nanoparticle Structures for SERS Detection

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FDTD simulation to calculate the transmission spectrum and the electric field distribution were performed for the flow-through Ag-NHAs, Figure S1, and Au-NHAs, Figure S2. Both periodic NHA structures have a 200 nm hole diameter and 400 nm periodicity. The NHA structures are comprised of a 200 nm layer of silicon nitride (Si_3N_4), a 5 nm adhesion layer of chrome (Cr), and a 100 nm layer of gold (Au-NHA) or silver (Ag-NHAs), respectively. Figure S1a shows the transmission spectra of the Ag-NHAs with the highest resonance peak situated at 660 nm. Figure S1b shows the e-field distribution of the Ag-NHAs plasmonic response under an excitation wavelength of 785 nm. The region with the highest e-field enhancement is located at the rim of the nanoholes, with a maximum calculated G_{SERS} of 721. Figure S2a shows the transmission spectra of the Au-NHAs with a resonance peak situated at 670 nm. Figure S2b shows the e-field distribution of the Au-NHAs plasmonic response under an excitation wavelength of 785 nm. The region with the highest e-field enhancement is also located at the rim of the nanoholes, with a maximum calculated G_{SERS} of 2087. The higher enhancement factor of the Au-NHAs is attributed to the proximity of the plasmonic resonance peak to the Raman excitation wavelength of 785 nm.

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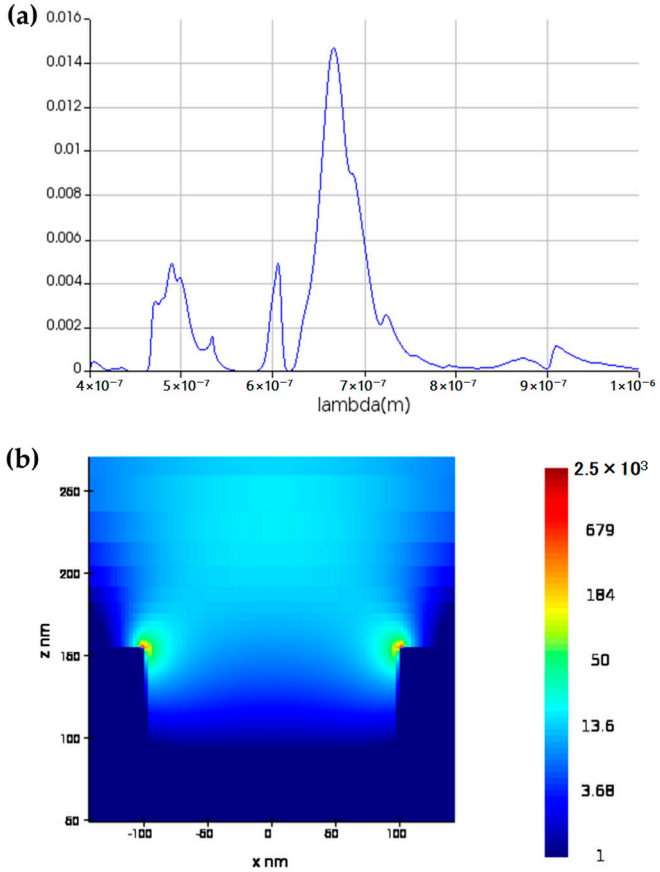

Figure S1. Silver NHA FDTD simulations show the (**a**) transmission spectrum and the (**b**) Electric field distribution ($|\mathbf{E}/\mathbf{E}_0|^4$) of the electromagnetic Raman enhancement factor.× 10^{-7}

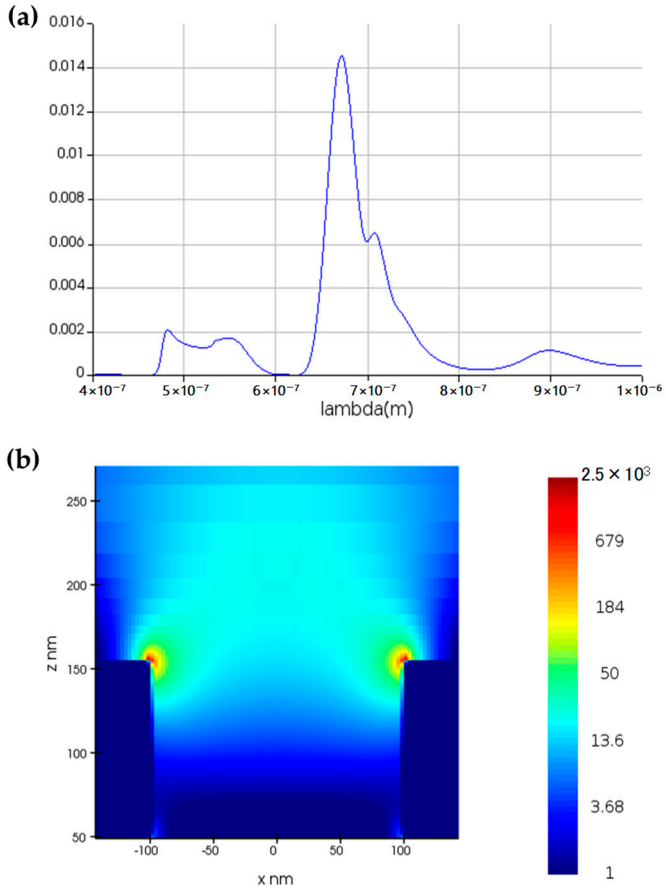

Figure S2. Gold NHA FDTD simulations show the (**a**) transmission spectrum and the (**b**) Electric field distribution ($|\mathbf{E}/\mathbf{E}_0|^4$) of the electromagnetic Raman enhancement factor.