<Supporting Document>

Highly-ordered close-packed metallic nanotube array for surface-enhanced Raman scattering

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Optical absorbance measurement result

In this study, a UV-VIS/NIR spectrophotometer (Jasco V-670) was used to measure the optical absorbance properties. The measurements were conducted in Abs Photometric Mode with a scanning speed of 400 nm/min over a wavelength range of 200–2000 nm. To evaluate the light absorption properties of the rhombic MeNTA, a silicon substrate was used as the reference. The absorption spectrum of the bare silicon substrate, shown in Figure S1(a), was obtained as the baseline signal. Then, the absorption spectrum of MeNTA was measured. By subtracting the baseline signal from the bare silicon, the spectrum in Figure S1(b) was obtained, representing the absorption spectrum of rhombic MeNTA. From the UV-Vis absorption spectrum, it can be observed that the 532 nm excitation laser source used in our Raman measurements falls within the absorption range of MeNTA. This alignment enables MeNTA to achieve excellent absorption, thereby enhancing the SERS effect.

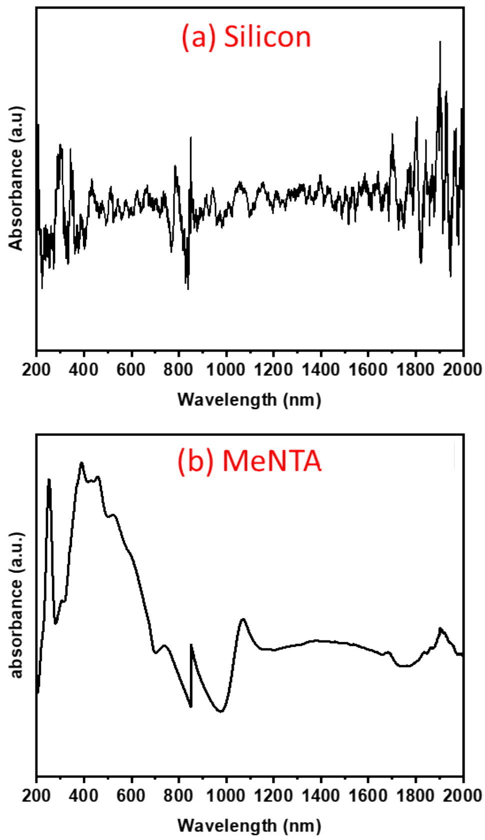

Figure S1. UV-Vis optical absorbance measurement results of (a) bare silicon and (b) MeNTA.

FDTD simulation result

Raman intensity directly influenced by the polarization direction of the incident light. The FDTD simulation results of rhombic MeNTA in different polarization directions are shown in Figure S2. The Raman intensity was clearly influenced by the orientation of laser polarization relative to the MeNTA substrate, with the highest E_{max}/E_0 value of 15.2 observed at θ = 90°. These FDTD results also validate the observed experimental findings in Figure 5.

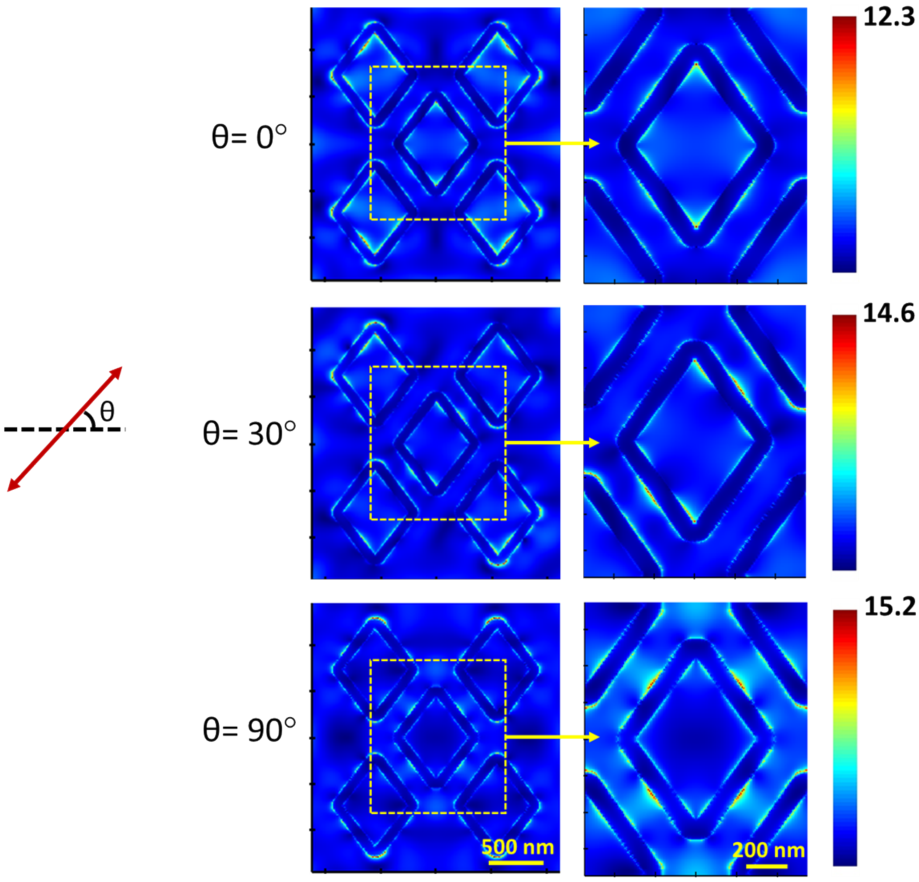

Figure S2. FDTD-simulated $|E/E_0|$ distributions (indicated by the color bar) of nanotubes under laser irradiation with polarization in various directions (θ) relative to the orientation of nanotubes.