

# Tunable Surface-enhanced Raman Scattering Probes for Single Biomolecular Detections

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Biomolecular detection using Raman spectroscopy offers several advantages. Detection with the technique is able to give vibrational modes to elucidate structural information about the target molecule, also can be observed for longer periods prior to photodestruction. However, Raman spectroscopy has an inherent problem from its low cross-section. Surface-enhanced Raman scattering (SERS) using nanostructured substrates can overcome the problem with its detection limit up to 6-10 orders of magnitude over conventional Raman spectroscopy. Among the several nanostructural requirements of the substrates, nanoparticle sizes (15-200 nm) and interparticle spaces (0-10 nm) are crucial for large enhancement factors. More important part is SERS characterizations with different sizes of molecules respect to different space. Large molecules may not be diffused into a small interparticle gap and absorbed on the metal particles where the magnetic field is locally intensified. Here we have demonstrated that seeding of colloidal Au nanoparticles on the glass substrates and growing to control the critical spacing of "hot spot," which can enhance SERS depending on the size of molecules and distance between nanoparticles. The growth results were monitored every 5 min for 30 min. Among all the substrates, the 30 min growth substrate under 0.1% HAuCl<sub>4</sub>/40mM NH<sub>2</sub>OH condition gave the highest SERS capability. Its detection limit reaches up to picograms of our target biomolecules such as glutamine, tryptophan, tyrosine, angiotensin II, and angiotensin III. The other substrates did not show SERS properties since the interparticle space were not well optimized. We have found there is a crucial timing which determines SERS capability. Thus we are planning to show more fine tunings between detectable molecular sizes and interparticle spaces.

Word counts: 267

## Reference

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