DNA-GUIDED ASSEMBLY OF PLASMONIC NANOSTRUCTURES FOR SURFACE-ENHANCED RAMAN SPECTROSCOPY (SERS)

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KEYWORDS: SERS, DNA, self-assembly, molecular detection

Plasmonic nanomaterials have been widely utilized in biosensing in recent years. Surface-enhanced Raman spectroscopy (SERS), which uses metallic nanoparticles or nanostructures to enhance Raman signals, has been a very active research field in recent years because it can be used for rapid detection of molecules without complex sample preparation. The sensitivity and reproducibility of SERS biosensing, however, greatly depend on the shape, material, and arrangement of the plasmonic nanomaterials. For instance, many studies have shown that the size of the gap between the nanoparticles used to enhance Raman signals should be as small as a few nanometers, and any slight variation in the gap size can greatly affect the SERS effects. In this study we report a DNA-guided assembly method that can be used to synthesize SERS-active core-satellite nanostructures. A large number of gold nanoparticles are attached to each silica bead using DNA, and a silver layer is coated outside of each gold nanoparticles, as shown in Fig. 1a. The small gaps between adjacent Ag-Au core-shell nanoparticles are the locations of SERS hot spots for molecular detection. Fig. 1b shows the results of the SERS detection of adenine obtained with and without the synthesized SERS substrate. Our results show that the DNA-guided assembly method developed in this study allows us to create sensitive and reproducible SERS nanostructures in a simple and low-cost way.

Figure 1(a) SEM image of the synthesized SERS-active core-satellite nanostructures. (b) SERS spectra of adenine. Red solid line is measured using the nanostructures that have silver shells, and the green dashed line is measured using the nanostructures that do not have silver shells. The black dashed line is measured without SERS nanostructures.