Label-free High Amplification SERS Detection with Nanostructured Substrates

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Surface enhanced Raman scattering (SERS) is a sophisticated analytical sensing method for biological and chemical sensing applications capable of detecting extremely low concentrations of a target analyte, even one molecule [1,2]. Its powerful detection capabilities are emphasized by the analyte identification without the use of artificial probes or labels (label-free detection). The detection of a fast ultra-low concentrations of analytes is of great significance for medical diagnostics, biomedical monitoring, food safety, and therapy [3,4].

In this work, simple, repeatable and cost effective methods [5-7] for obtaining ordered distribution of gold nanoparticle platforms with very high enhancement Raman signal are presented and successfully used for SERS detection of several analytes. Self-ordered distributions of nanoconcavities (Figure 1) and nanomounds substrates are obtained with several formation methods [8-12]. They all are decorated with metallic self-ordered nanoparticles formed by sputtering deposition and thermal annealing (Figure 2). The dependence of the size and shape of the resultant nanoparticles on the sputtering and thermal parameters is studied in depth, as well as the influence of the distribution of the patterned substrates (separation and diameter of the nanoconcavities and nanomounds).

The fabricated platforms are demonstrated to be excellent sensing SERS substrates for the detection of a broad range of molecules and medicines [13,14]. Also a complete evaluation of the different parameters of the fabrication steps parameters is presented.

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Figures

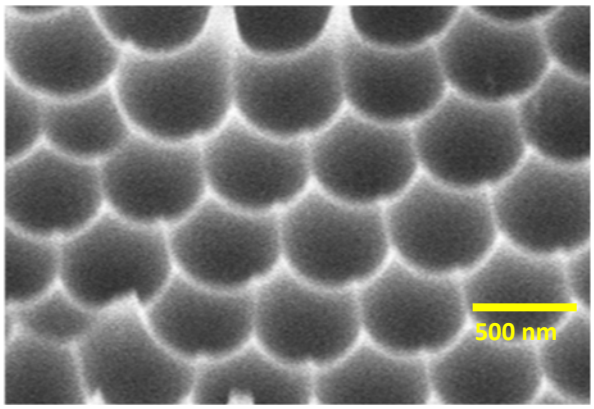

Figure 1. FESEM image of Al nanobowls of diameter ~500 nm.

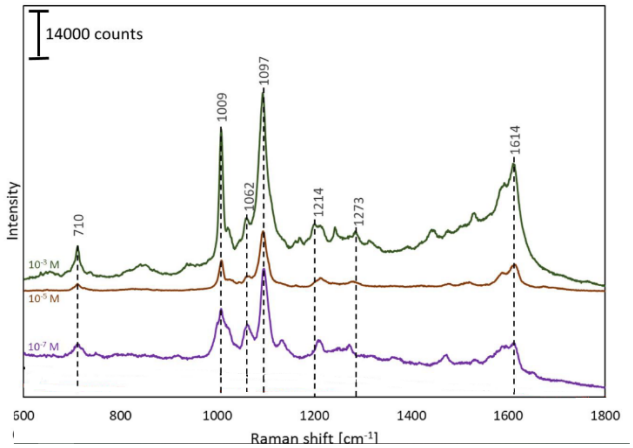

Figure 2. SERS spectra obtained with one of the developed substrates detecting several concentrations of 4-Mpy.