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Self-assembled Au Nanoparticle Arrays with Engineered Hot Spots for SERS A. CHEN, U. WELP, V. VLASKO-VLASOV, Material Science Division, Argonne National Laboratory, A.E. DEPRINCE III, A. DEMORTIERE, A. JOSHI-IMRE, E.V. SHEVCHENKO, S.K. GRAY, Center for Nanoscale Materials, Argonne National Laboratory — We demonstrate a cost-effective bottom-up self-assembly of 80 nm Au nanoparticles (NPs) with controllable regular arrays of hot spots for high-fidelity and high-sensitivity sensor applications. The self-assembly of gold NPs is implemented using solvent evaporation techniques. By careful control of surface stabilizers on NPs and optimization of assembly conditions, we fabricated hcp arrays of NPs extended over more than 200 μm. Electromagnetic hot spots localized in the nanometer gaps between Au NPs are well defined and reproducible over large areas of the arrays. UV-Vis-NIR extinction spectra of our 2D plasmonic crystals exhibit unique resonances due to strong particle-particle interactions, in a good agreement with results of our finite-difference-time-domain (FDTD) simulations. We experimentally demonstrate large enhancements of both photoluminescence and surface enhanced Raman scatterings of 5nm CdSe quantum dots coated on 80nm Au NP arrays. High-resolution SEM imaging of quantum dots gave a precise estimate of their density and positions and allowed direct evaluation of the enhancement factors.

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