Gold Nanoparticle-based supercrystals as Surface Enhanced Raman Scattering (SERS) substrates

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We present a straightforward method to produce large area plasmonic crystals with sub-micrometer periodicity using pre-patterned soft molds.[1],[3] We demonstrate the assembly of gold nanoparticles into square lattices with pitch sizes as low as 400 nm. Optical characterization of the supercrystals by means of microspectroscopy allows the identification of distinct extinction peaks that can be attributed to the hybridization of the nanoparticles plasmon resonance with the modes arising from the cluster organization and lattice modes.[2] Further, we show the tunability of the lattice mode resonance throughout the visible and into the near infrared range. Consequently, our supercrystals can be designed to act as surface enhanced Raman spectroscopy substrates that are specifically tailored for a desired excitation wavelength.[4] The SERS response of 4-acetoamidothiophenol has been studied on different supercrystal assemblies and the optimum substrate for 785 nm excitation has been identified. We successfully fabricated large area assemblies of gold nanoparticles acting as SERS substrates, exhibiting exciting optical properties from the visible to the NIR range. These results open up the way to further exploit supercrystal assemblies for sensing and many other photonic applications.

References

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Figures

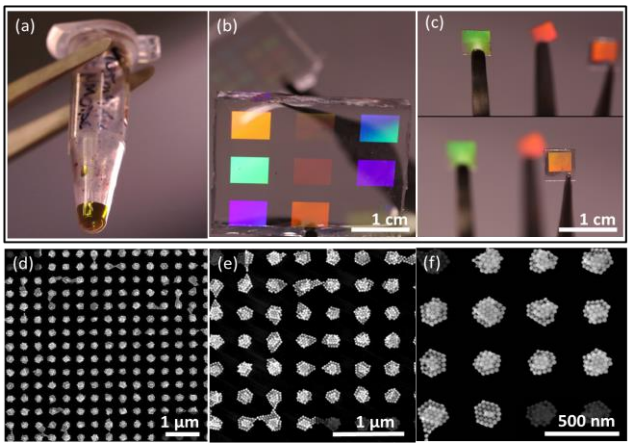

Figure 1: Photograph of (a) colloidal solution of AuNP, (b) PDMS (c) Macro image of NPs assembly (d), (e), (f) top view SEM micrographs illustrating the square lattice of Au NP clusters with different magnifications.