Size Control of Gold Nanoparticle Assembly by Manipulation of Inter-particle Interaction

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Gold nanoparticles have attracted much attention in the past decade for the study of colloidal system due to their stability, uniformity, and optical properties. We control the size and stability of gold nanoparticle assembly in aqueous solution by manipulating the inter-particle interaction. To control the inter-particle interaction of gold nanoparticles, we utilize the competitive adsorption of organic adsorbates on the particle surface. Various experimental techniques such as quasi-elastic light scattering (QELS), UV-via absorption spectroscopy, and surface-enhanced Raman scattering (SERS) are used to characterize the particles. Our findings suggest that replacing the trivalent citrate ions adsorbed on the particle surface with monovalent mercaptan ions destabilizes the particles, causing aggregation and hence the increase in final size. This is successfully explained by the classical DLVO (Derjaguin-Landa-Vervey-Overbeek) theory that describes the inter-particle interactions and colloidal stability in solution.

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