Title: Fundamental Studies of Monolayer-Protected Nanoparticles by Gas Chromatography

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Description: Monolayer-protected nanoparticles (MPNs) are gaining considerable interest in the nanotechnology field, especially for chemical sensor development. The selectivity achieved for chemical sensing with gold MPNs is dominated by the chemical sensor development. The selectivity achieved for chemical sensing with gold MPNs is dominated by the chemical structure and functionality selected for the organic surface layer, which is a thiol-linked chemical functionality bound on the surface of each gold nanoparticle. There is considerable interest to study MPN materials in more detail in order to understand on a fundamental level their sorptive properties. Knowledge of the sorptive properties of MPNs would provide valuable insight into the thermodynamics of vapor sorption by MPNs. In this proposed work, gas chromatography (GC) will serve as a very versatile platform for the characterization of gold MPNs. Furthermore, the physical nature of the MPNs should make them an intrinsically efficient and versatile GC stationary phase. GC retention time data will be related to thermodynamic properties of the MPNs, while the band broadening observed in the GC data will be readily related to the mass transfer characteristics of the MPNs. A wide range of chemical sensing layers on the MPNs will be explored. Ideally, each of the MPN materials will provide a different GC retention factor for the wide array of analyte vapors that will be studied. The variations in chemical selectivity, as observed through GC retention data, should engender the MPN materials useful for a broad range of either sensor array or GC stationary phase applications. Successful completion of this project will be marked by the thermodynamic characterization of the vapor phase sorptive properties of monolayer protected gold nanoparticles as well as the use of these nanoparticles as a novel stationary phase strategy for gas chromatography.