Self-Assembly of Polymer-Coated Gold Nanoparticles

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Self-Assembly of nanoparticles (NP) is a promising tool for the synthesis of new materials with tailored properties. (1) Using polymer-ligands provides additional possibilities to direct the self-assembly and tune the mechanical, electrical or optical/plasmonic properties of the resulting materials. In the case of gold nanoparticles (AuNP), the plasmonic properties are especially interesting for surface-enhanced spectroscopies and fundamental studies. Two recent studies will be presented. In the first study we show that it is possible to obtain well-ordered, mono- and multilayer films of AuNP coated with polystyrene-based ligands (PS), with AuNP diameters up to 45 nm. Monolayers > 2x10^4 µm^2, and freestanding films > 1.6x10^3 µm^2 were obtained. The role of ligand size for functionalization and self-assembly of AuNP ranging from 6-90 nm in diameter was tested. (2) In the second study based on recent works (3, 4) we observed the crystallization of poly(ethylene glycol) (PEG) coated AuNP in solution induced by hydrostatic pressure. This new effect was studied by small-angle X-ray scattering (SAXS) and we describe a parameter study resulting in a phase diagram for the system.

Figure 1. Freestanding monolayer film of polystyrene-coated AuNP (d ~ 45 nm)

References

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