

Investigation of self organization of Nanoparticles and Biomolecules using X-ray scattering

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The self-organization of nanoparticles capped with organic molecules or the biomaterials arises from the competition of various forces like van der Waals, electrostatic, adhesion etc. between the molecules and the substrates. Solid substrates are being used routinely to understand the mechanism but strong interaction restricts their self-assembly. The results of x-ray reflectivity (XRR) and grazing incidence small angle x-ray scattering (GISAXS) studies to understand the self-organization of nanoparticles and lipid bilayer membrane will be discussed. Two different shapes of nanoparticles, 1) spherical Au nanoparticles and 2) ZnS nanorods on water surface are studied using GISAXS experiments. The results revealed a superlattice structure as a function of surface pressure for the Au nanoparticle. ZnS nanorods on water surface first grow along the length and then attach side by side to form a sheet on water surface. On the other side, lipid bilayer membranes are stable only under water and bilayer membrane on a polymer brush has been prepared to understand the transport mechanism of protein or other molecules through the lipid membranes. High energy x-ray beam has been used to measure the reflectivity from the samples under water. XRR studies revealed the lipid head group specificity of the proteins attachment procedure and related organization of those molecules on the membrane surface.