

Abstract Submitted
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Two-dimensional self-assembly of DNA-functionalized gold nanoparticles¹ WENJIE WANG, HONGHU ZHANG, NOAH HAGEN, Ames Laboratory and Iowa State University, IVAN KUZMENKO, Argonne National Laboratory, MUFIT AKINC, ALEX TRAVESSET, SURYA MALLAPRAGADA, DAVID VAKNIN, Ames Laboratory and Iowa State University — 2D superlattices of nanoparticles (NPs) are promising candidates for nano-devices. It is still challenging to develop a simple yet efficient protocol to assemble NPs in a controlled manner. Here, we report on formation of 2D Gibbs monolayers of single-stranded DNA-coated gold nanoparticles (ssDNA-AuNPs) at the air-water interface by manipulation of salts contents. MgCl₂ and CaCl₂ in solutions facilitate the accumulation of the non-complementary ssDNA-AuNPs on aqueous surfaces. Grazing-incidence small-angle X-ray scattering (GISAXS) and X-ray reflectivity show that the surface AuNPs assembly forms a mono-particle layer and undergoes a transformation from short-range to long-range (hexagonal) order above a threshold of [MgCl₂] or [CaCl₂]. For solutions that include two kinds of ssDNA-AuNPs with complementary base-pairing, the surface AuNPs form a thicker film and only in-plane short-range order is observed. By using other salts (NaCl or LaCl₃) at concentrations of similar ionic strength to those of MgCl₂ or CaCl₂, we find that surface adsorbed NPs lack any orders. X-ray fluorescence measurements provide direct evidence of surface enrichment of AuNPs and divalent ions (Ca²⁺).

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