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Basic parameters affecting nanoparticle self-assembly: An experimental approach CHAKRA JOSHI, The University of Toledo, Department of Chemistry, YEVGEN KRYUKOV, JACQUES AMAR, University of Toledo, Department of Physics and the Wright Center for Photovoltaics Innovation and Commercialization, TERRY BIGIONI, The University of Toledo, Department of Chemistry and the Wright Center for Photovoltaics Innovation and Commercialization — Understanding the basic parameters that govern the nanoparticle self-assembly process is important for high-quality monolayer formation and technological advances. A complete theory that explains nanoparticle self assembly, in the bulk and at the liquid-air interface, is lacking. In this paper, dodecanethiolated gold nanoparticles were used as a model system for studying the forces that govern self assembly. These nanoparticles are known to make compact and highly-ordered monolayers at the liquid-air interface via a mechanism that is analogous to epitaxial growth of atomic layers. Epitaxial theory was used as a starting point to study the nanoparticle self-assembly at the liquid-air interface. Experimental measurements were successfully interpreted using an epitaxy-based analysis, including flux of nanoparticles onto the liquid air-interface, decay rate of the island density, and the dependence of critical nucleus size on nanoparticle diameter. Furthermore, anomalous diffusion was observed as was a remarkable ordering of islands at the liquid-air interface. This ordering was determined to be due to a long-range repulsive force between islands.

Chakra Joshi
The University of Toledo, Department of Chemistry

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