Poster for NSF Integrative Graduate Education and Research Traineeship (IGERT) Symposium, May 18-20, 2008, Arlington, VA.

SAND2008-3675C

Self-Assembly of Well-Ordered, Close-Packed 2D Arrays of Recombinant Virus-Like Particles that Nucleate the Growth of Inorganic Nanomaterials

Carlee Ashley, Darren Dunphy, Dimiter Petsev, Plamen Atanassov, and David Peabody, University of New Mexico; C. Jeffrey Brinker, University of New Mexico and Sandia National Laboratories

Due to their high degree of monodispersity, their highly symmetrical geometries, and the ease with which their protein capsids can be genetically engineered, bacteriophages are well-suited for use as templates in the spatially-defined self-assembly of inorganic materials into highly-ordered nanostructures. To this end, we used an evaporation-driven deposition technique, convective assembly, to self-assemble 28-nm icosahedral bacteriophages, MS2 and Qβ, into well-ordered hexagonal close-packed (*hcp*) monolayers, the long-range order of which was confirmed via Grazing Incidence Small-Angle X-ray Scattering (GISAXS) characterization at a synchrotron source. Convective assembly enables rapid deposition of colloidal particles onto a hydrophilic surface by trapping microliter-sized droplets between two fixed-angle plates and dragging the ensuing meniscus across a surface with constant velocity. We utilized i*n-situ* GISAXS to monitor the time-dependent development of bacteriophage nanostructures and to determine the affect of particle-particle and particle-substrate interactions on long-range order. We patterned surfaces with alternating hydrophobic and hydrophilic regions; phage particles selectively wet hydrophilic regions, enabling us to ultimately construct patternable devices with nanometer-sized features. We then engineered virus-like particles (VLPs) of MS2 to express, at specific surface locations, non-native peptides that have been demonstrated to either nucleate the growth of gold from an aqueous salt solution or condense silica from silicic acid under neutral pH conditions. We are currently working on selectively condensing silica on the surfaces of *hcp* VLP structures while nucleating the growth of gold nanoparticles within VLP capsids in order to create "nano-capacitors" and other devices with unique electrical and optical properties.

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.