MECHANICAL ENGINEERING *SEMINAR*

Multifunctional and Biological Scaffolds for Energy Applications

Dr. Ki Tae Nam
Molecular Foundry, Lawrence Berkeley National Laboratory

Bio-systems have inherently developed very specific molecular recognition patterns that can be manipulated through genetic control. It also can be used to exert molecular scale control over nucleation, growth, and stabilization of inorganic materials, analogous to the process of biomineralization. Furthermore, due to the remarkable capability of biological molecules to self-assemble at multiple length scales, the opportunity exists for designing novel nanomaterials via genetic modification and then constructing hierarchically assembled structures. The combination of biological self-assembly and biosynthesis of nanomaterials can enable us to create entirely new concepts applications and devices. In my presentation, I will describe how the biological approach not only contribute to improving the properties of current energy devices but also provide a new paradigm for designing highly efficient, small scale energy devices. We choose the M13 virus as a genetic based toolkit to realize our idea- “from DNA to the functional device”. M13 virus was genetically engineered to grow and assemble the electrochemically active materials for Li ion battery electrode. We applied our understanding of the interaction between the specific protein and metal in order to grow nanomaterials on the major coat proteins of the virus. Additionally, the principles of biological self-assembly and biotemplating was further extended to control virus-virus interactions for organizing nanostructured electrodes in two dimension. By harnessing the electrostatic nature of the assembly process with the functional properties of the virus, we can create highly ordered composite thin films combining the function of the virus and polyelectrolyte multilayer systems.

Dr. Ki Tae Nam is a postdoctoral fellow at the Molecular Foundry in the Lawrence Berkeley National Laboratory (http://foundry.lbl.gov/). He received his Ph.D. in Material Science and Engineering at the Massachusetts Institute of Technology in 2007. His thesis work, under the guidance of Professors Angela Belcher (http://belcher10.mit.edu/), investigated a new way of exploiting biological entities for the bottom-up assembly of battery devices by utilizing biological self-assembly and biotemplating. He received the outstanding Ph.D. thesis research award from MIT.

Thursday, MARCH 6, 2008

12:00 pm Seminar in 233 Mudd
1:00 pm Lunch in ME Lobby