

UNH Materials Science Seminar

11:00-12:00, Thursday, April 6, 2006

DeMeritt Hall 209B

University of New Hampshire

"Colloidal molecules": Synthesis and engineering design

Professor Darrell Velegol
Pennsylvania State University

Technologies in sensors, MEMS, drug delivery, computing, robotics, and other applications will increasingly require assemblies of colloidal and nanocolloidal particles. Such small particles must be built from the "bottom-up", meaning that the particles must be designed so that they can assemble themselves. Thus, just as atoms assemble into molecules with structures ranging in complexity from carbon monoxide to DNA, our goal is to design and synthesize particles that self-assemble into larger structures. We are currently working with polymer, oxide, and metal particles.

Several techniques exist to produce simple bottom-up assemblies, and all techniques have limitations. In this talk a new method from our lab called "particle lithography" will be presented. Currently we have used this technique to produce high-yield, accurate heterodoublets of micron size particles. Techniques for engineering the nanoscale unit operations will be presented, with the aim of producing scalable, portable, low-cost methods for producing a wide range of assemblies.

Darrell Velegol attended West Virginia University for his BS in Chemical Engineering, and he earned his PhD in Chemical Engineering at Carnegie Mellon University in 1997 working with Professors John L. Anderson and Stephen Garoff. In 1998 Velegol won the Victor K. LaMer Award of the American Chemical Society for the best PhD in the field of Colloid & Surface Science. He continued with a post-doc in the Center for Light Microscope Imaging and Biotechnology at Carnegie Mellon, working under Professor Fred Lanni of the Biology Department. In June 1999 Velegol joined the Department of Chemical Engineering at Penn State, where he was promoted to Associate Professor in 2005. Velegol won an NSF CAREER Award in 2000, and in 2003 he led a group in winning an NSF NIRT grant on bottom-up particle assembly. Currently he works with 5 PhD students. His research investigates nanocolloid dispersion, colloidal charge nonuniformity and "colloidal molecules", and bacterial adhesion. His group uses a wide range of experimental, theoretical, and numerical approaches. Velegol is a member of ACS, AIChE, AAAS, ASM, and ASEE. His mission at Penn State reads, "Bigger freedom, bigger hope."