UNH Materials Science Seminar

11:10-12:00, Thursday, September 14, 2006
DeMeritt Hall 209B, University of New Hampshire

3D Design of Self-Assembled Nanoporous Particles

Professor Igor Sokolov, Clarkson University

A combination of inorganic crystal growth and self-assembly observed in the biological world can bring to reality synthesis of new materials that have not yet been created in Nature. Using organic liquid crystals as templates for inorganic precursors has already shown its potential. Biomimetic synthesis of extraordinary curved nanoporous silica colloidal shapes, such as rods, discoids, spheres, tubes and hollow helicoids has been reported. Pores have cylindrical shape. To some extent, each particle is an array of tightly packed silica nanotubes. Ability to control the shapes portends a variety of applications and new technologies where nanostructure and geometry determine function. Here I show what principles stand behind the assembly of such particles, and what determines their shapes (morphogenesis). I am analyzing morphogenesis of nanoporous silica shapes. A theoretical basis will be outlined to describe the variety of forms and surface designs that result from the liquid crystal stage, silicification and rigidification of silicate liquid crystals. The main factors that are responsible for shape formation will be described. Synthesis of several the most prospective shapes will be presented. Potential applications of such particles, including ultra-bright fluorescent sensors, drug delivery, storage capsules for bioactive molecules, self-healing materials, etc. will be outlined.

Professor Sokolov is Associate Professor, Department of Physics, Clarkson University. He received his Ph.D. in Physics, D.I. Mendeleev Central Metrology Institute, St. Petersburg, Russia in 1991. He has 87 refereed publications, 1 full US patent, and 7 US and 1 International patents pending, 57 invited lectures, seminars, conference presentations; participation in 46 conferences with contributed presentations. His areas of interest include Soft Condensed Matter Physics, Biophysics, Surface Science, Nanomechanics. His current research is in Self-healing materials; Nanomechanics of human cells; AFM/confocal/electroluminescent characterization of human skin; Self-assembly of nanoporous silicas and their applications.