Materials Science & Engineering Seminar Series

Carnegie Mellon University
Materials Science & Engineering

presents

Polymer-Nanoparticle Mesostructures and Their Mechanics

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A critical challenge exists in the ability to transform advanced materials components synthesized at the nanoscale into robust macroscale structures, while maintaining the advantageous attributes of the original nanoscale constituents. In nature, this challenge is addressed through the assembly of nanoscale building blocks, e.g. proteins, into mesocale structures, e.g. fibrils, helices, and sheets, which subsequently assemble into structures with enhanced properties andfunctions. Taking inspiration from these ubiquitous principles that promote scalability in nature, we are developing processes to assemble synthetically tailored nanoscale building blocks into robust mesoscale structures, including fibrils, helices, and sheets. These transformation processes take advantage of the balance between surface energy and elasticity, leading to a robust, geometric approach for secondary structure formation. We have initiated a thorough study of the mechanics of these structures, which offer promise in applications ranging from flexible electronics to advanced coatings. Overall, these stories will provide insight into how we think as a group and learn from nature without losing focus on the importance of fundamental materials principles and engineering design.

Bio:
Al is a materials scientist and engineer interested in the mechanics of soft materials and biological systems. He received his B.S. degree in Civil Engineering and Applied Mechanics at the University of Virginia in 1996 and his Ph.D. in Materials Science and Engineering at Northwestern University in 2000. After completing a National Research Council Postdoctoral appointment at the National Institute of Standards and Technology (NIST), he joined the UMass Amherst faculty in Polymer Science & Engineering in 2002 where he leads a research group focused on learning and using lessons from nature to understand and design materials. His research on adhesion, wrinkling, cavitation, and nanoparticle assemblies has garnered international acclaim and numerous honors and awards, including Geckskin™ being named by CNN/Money/Fortune Magazine among the 5 Scientific Breakthroughs of 2012. He has published more than 100 papers, has delivered well over 125 invited and plenary lectures, and has been highlighted extensively in the popular media. He holds several patents for the technologies that have evolved from his group's research.

Doherty Hall 2210, 11:30AM
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