UNH Materials Science Seminar

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Kingsbury Hall S145
University of New Hampshire

Self-Assembled Biodegradable Block Copolymers and DNA Lipoplexes as Potential Delivery Systems

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Polymeric nanoparticle formation via self-assembly is an attractive approach for delivery systems. In this presentation, we focus on two self-assembled polymer and biopolymer systems, namely, biodegradable block copolymers and DNA lipoplexes. In the first system, incompatible blends of poly(ethylene oxide)-*b*-poly(L-lactide) (PEO-PLLA) and poly(ethylene-*co*-butene)-*b*-poly(D-lactide) (PEB-PDLA) were studied. Stereocomplexation between biodegradable PLLA and PDLA induced intriguing phase morphologies. When the molecular weight of PEB (4.2k) was higher than that of PEO (2k), inverted honeycomb cylindrical morphology was observed in the melt, whereas biomimetic onion-like crystals were obtained in the solid-state. We believe that noncentrosymmetric lamellar morphology was responsible for the onion crystal formation, which was induced by unbalanced surface stresses at basal planes of the stereocomplex lamellar crystals. In the second system, synthetic cationic lipids having various molecular shapes

were used to complex with double-stranded DNA. When the shape of the lipid tails changed from rod-like (cyanobiphenyl), to discotic (triphenylene), and finally to cubic [polyhedral oligomeric silsesquioxane (POSS)], the liquid crystalline structures of the DNA lipoplexes transformed from lamellar to inverted hexagonal. We attributed this change to the negative curvature of the POSS imidazolium lipid. Potential applications for biomimetic onion crystals and organic/inorganic DNA nanocomposites may be controlled drug and gene delivery.

Lei Zhu received his B.S. degree in Materials Chemistry in 1993 and M.S. degree in Polymer Chemistry and Physics in 1996 from Fudan University. He received his Ph.D. degree in Polymer Science from University of Akron in 2000. After two-year post-doctoral experience at the Maurice Morton Institute, University of Akron, he joined the Institute of Materials Science and Department of Chemical, Materials and Biomolecular Engineering at University of Connecticut. In 2007, he was promoted to associate professor. His research interests include supramolecular self-assembly of discotic liquid crystals, organic-inorganic hybrid nanomaterials for capacitor applications, development of artificial antibody as nanomedicines, and polyelectrolyte membrane fuel cells. He is recipient of an NSF Career Award, 3M Non-tenured Faculty Award, DuPont Young Professor Award, and Rogers Teaching Excellence Award. He is author and co-author of 58 refereed journal publications, 3 book chapters, and numerous conference proceedings.

Host: Professor Marshall Ming x1446