UCF | Materials Science and Engineering

UNIVERSITY OF CENTRAL FLORIDA

MATERIALS SCIENCE & ENGINEERING DISTINGUISHED SEMINAR SERIES

Darrin Pochan, Ph.D.

Professor and Chair

Department of Materials Science & Engineering

University of Delaware

Friday

September 27, 2019

11:00AM — 12:00PM

HEC

Room 101

Contact: Dr. Tengfei Jiang

Materials Science & Engineering

Phone: 407-823-2284

Email: Tengfei.Jiang@ucf.edu

Biomolecules for Non-biological things: Materials Construction through Peptide Design and Solution Assembly

Self-assembly of molecules is an attractive materials construction strategy due to its simplicity in application. By considering peptidic molecules in the bottom-up materials self-assembly design process, one can take advantage of inherently biomolecular attributes; intramolecular folding events, secondary structure, and electrostatic interactions; in addition to more traditional self-assembling molecular attributes such as amphiphilicty, to define hierarchical material structure and consequent properties. Two classes of materials will be discussed. First, a brief introduction to beta-hairpin self-assembly will be presented. Importantly, intermolecular self-assembly into a nanofibrillar network morphology does not occur until individual peptide molecules intramolecularly fold into a beta-hairpin conformation. Subsequently, specific, intermolecular assembly occurs into a branched nanofibrillar network. During assembly and gelation, desired components can be encapsulated within the hydrogel network (e.g. drug compounds, living cells). The system can shear thin but immediately reheal to preshear stiffness on cessation of the shear stress. Recently, the materials have been adapted to high throughput screening.

Second, a new solution assembled system comprised of theoretically designed coiled coil bundle motifs will be introduced. The molecules and nanostructures are not natural sequences and provide opportunity for arbitrary nanostructure creation with peptides. With control of the display of all amino acid side chains (both natural and non-natural) throughout the peptide bundles, desired physical and covalent (through appropriate “click” chemistry) interactions have been designed to produce one and two-dimensional nanostructure. One-dimensional nanostructures span exotically rigid rod molecules that produce a wide variety of liquid crystal phases to semi-flexible chains, the flexibility of which are controlled by the interbundle linking chemistry. The two dimensional nanostructure is formed by physical interactions and are nanostructures not observed in nature. All of the assemblies are responsive to temperature since the individual bundle building blocks are physically stabilized coiled coil bundles that can be melted and reformed with temperature.

Biography: Darrin Pochan is currently Professor and Chair of the Materials Science and Engineering Department as well as having appointments in the Delaware Biotechnology Institute and Department of Chemistry at the University of Delaware. Since joining the MSE department in 1999 after a Ph.D. in Polymer Science and Engineering at the University of Massachusetts-Amherst and a National Research Council Post-doctoral fellowship at the National Institute of Standards and Technology in Gaithersburg, MD, he has developed a research program around the construction of new materials and nanostructures via molecular solution assembly mechanisms. Areas of focus are biomaterials and materials for nanotechnology and energy applications through organic/inorganic hybrids. His honors include an NSF Career Award, the DuPont Young Faculty Award, the Dillon medal from the American Physical Society and fellowship in the American Physical Society and American Chemical Society. Currently, Darrin also serves as Editor in Chief of Soft Matter published by the Royal Society of Chemistry in the United Kingdom.