

# UNH Materials Science Seminar

11:10-12:00, Thursday, Dec. 6, 2007

Kingsbury Hall S145

University of New Hampshire

## Toward Self-Healing Polymer Surfaces

Professor Marshall Ming

Materials Science Program, UNH

Self-healing capability is one of the trademarks of living tissues including plants and human bodies. It is extremely desirable to render man-made materials, including coatings, this capability, for the sake of prolonging the material lifetime and minimizing maintenance. There has been some recent success in preparing self-healing polymer materials, such as the autonomic healing via microencapsulated liquid healing agent and externally triggered repairing on the basis of thermally reversible Diels-Alder (DA) reaction or light-induced thiol-ene-based reaction; a common feature for these systems is that covalent bonds are reestablished (i.e., “chemical recovery”) to heal damages. I will discuss an autonomic “physical” recovery for a particular surface property of a material: low surface energy. We have successfully employed the surface segregation strategy to prepare low surface-energy, cross-linked films with fluorine-rich surfaces that are water/oil repellent, in which the addition of a small amount (1 wt%) of fluorine can lower the surface energy of the coating to as low as 10 mN/m. However, it has been shown that the fluorine-rich layer is generally very thin (< 20 nm), and the coating may not sustain the low surface-energy character upon mechanical abrasion. We have developed a self-replenishing strategy to sustain the low surface-energy character: in case of surface damage that leads to the loss of the top layers of the coating, fluorinated tails from sub-layers will be able to reorient themselves to minimize the air/film interfacial energy of the newly created surface. We will demonstrate how the self-replenishing of fluorinated species takes place and discuss a variety

of factors that have direct influences on the self-replenishing behavior. This self-replenishing strategy may also be extended to heal other functional coatings.

Weihua (Marshall) Ming received his B.S. (Materials Chemistry) in 1993 and PhD (Polymer Chemistry and Physics) in 1998, both from Fudan University in Shanghai. He spent about a year and half year as an exchange researcher at Eastern Michigan University from 1996-1997. After his PhD, he did his postdoc at Eindhoven University of Technology (The Netherlands) for two years, before he became a tenured University Lecturer (Assistant Professor) there. In October 2007, he joined UNH Materials Science Program as a Research Associate Professor. His current research interests include nanostructured, multifunctional polymer materials, self-healing polymers, and polymer hybrid composites.

Host: Professor Donald Sundberg