UNIVERSITY OF DELAWARE

WEDNESDAY, March 22nd
10:30 – 12:00 PM
Harker ISE Lab 322

MATERIALS SCIENCE & ENGINEERING

Rearranging the Covalent Connectivity in Polymeric Materials

Dr. Timothy Scott

Abstract: Covalently cross-linked polymer networks find utility as structural materials across a wide variety of applications where in situ polymerization, dimensional stability, environmental resistance, and permanence are required. Additional chemical functionality can be readily introduced to these networks by incorporating desired functional groups in the monomeric precursors employed for material fabrication; however, once set, the recycling, reuse, and post-polymerization manipulation of these covalently cross-linked networks are, as suggested by their common description as 'thermosets', limited. To address this shortcoming, strategies to afford adaptability in cross-linked polymers have focused on incorporating reversible covalent bonds within the network backbone of these otherwise intractable materials; thus, networks which contain a sufficient number and topology of 'dynamic' covalent bonds enable the cross-linked structure to respond chemically to an applied stimulus. This response, generally a change in the stress and/or shape (i.e., strain) of the material, is achieved without necessitating any irreversible network structure degradation by maintaining the cross-link density is while allowing rearrangement of the connectivity. Here, I will discuss the potential of polymeric materials which, upon irradiation, are able to rearrange their connectivity to relieve shrinkage stress and undergo rapid, photo-mediated healing. Further, I will detail the development of sequence-specific oligomers that employ dynamic covalent interactions to effect hybridization between strands of complementary sequences, mimicking the self-assembly commonly observed in complementary nucleic acid strands.

Bio – Timothy F. Scott received his BSc (Hons) in Chemistry from the University of Melbourne in 2002 and PhD in Materials Engineering from Monash University in 2006. He then proceeded to a postdoctoral research position with Prof. Christopher Bowman in the Department of Chemical and Biological Engineering at the University of Colorado at Boulder, followed by a research assistant professorship in the Department of Mechanical Engineering at the same institution. Currently an assistant professor in the Department of Chemical Engineering at the University of Michigan, Ann Arbor, his research focuses on the utilization of radical and dynamic covalent chemistries for fabrication and manipulation of polymers.