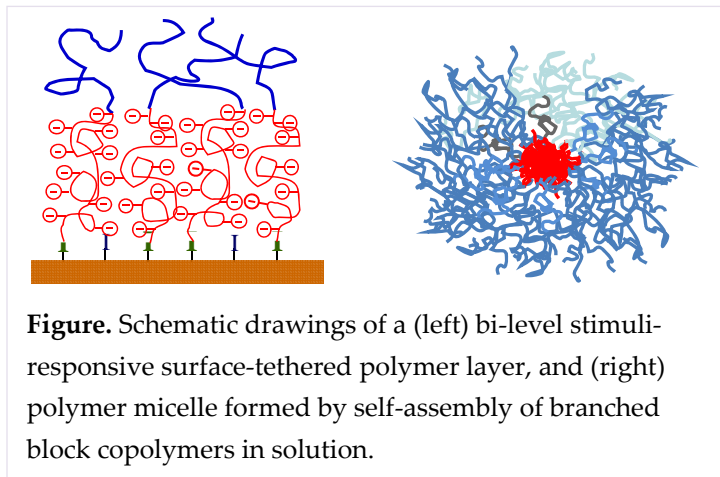


**Dr. S. Michael (Mike) Kilbey, II**  
**Associate Professor and UT/ORNL Joint Faculty**  
**Polymer Science and Nanotechnology**

The focus of my group's research activities is on understanding how the chemical information encoded into polymeric materials through synthesis affects their self-assembly, nanoscale structure, and properties. A variety of controlled polymerization strategies provide the ability to design polymer molecules having tailored sequence, composition, and connectivity. We seek to learn how our ability to turn these "dials" translates into changes in the structures they adopt in various environments, their adsorption behaviors, and their interactions with other molecules. Although the type of research we do is fundamental in nature, closing this loop between material design, structure and properties is crucially important for the development of next-generation materials and devices. Applications for our studies range from new materials for energy conversion technologies, advanced therapeutics for improved human health, or novel sensors or separation agents.

Our research efforts often involve synthesis and characterization of novel polymers, assembly of those materials into thin films or self-organized structures in solution (see Figure), and a variety of advanced methods suitable for measuring phase behavior, structure and interactions on length scales approaching molecular dimensions. A significant fraction of our focus is on "stimuli-responsive" polymers – these are polymers that undergo dramatic changes in conformation in response to changes in their local environment – and also polymers that have relevance in biotechnology,



**Figure.** Schematic drawings of a (left) bi-level stimuli-responsive surface-tethered polymer layer, and (right) polymer micelle formed by self-assembly of branched block copolymers in solution.

including polyelectrolytes and bioconjugates. Our general approach is to use controlled (free) radical polymerization methods to design sets of materials with changes in the layout of monomers, either by making block copolymers or random copolymers, examine their solution structure and dynamics, and measure their structure and structural changes in a variety of different environments.

Undergraduate students involved in our research activities are expected to become proficient in core techniques. Students more interested in polymer chemistry may learn various

polymerization methods, such as atom transfer (free) radical polymerization (ATRP), or reversible addition fragmentation chain transfer (RAFT) polymerization, or synthetic manipulations used to graft polymers to surfaces. Students inclined more toward polymer physical chemistry would become experts in various tools used to characterize thin film phase behavior or solution structures, such as phase modulated ellipsometry or atomic force microscopy, or laser light scattering. Because Prof. Kilbey is a UT/ORNL joint faculty member, many members of his group utilize resources at Oak Ridge National Laboratory to further their research activities. Undergraduate interested in working with Kilbey's group are expected to be self-motivated and have strong academic records, particularly in science and mathematics courses.