DEPARTMENT OF CHEMISTRY AND ENVIRONMENTAL SCIENCE
SEMINAR SERIES
SPRING 2018

DATE: FRIDAY, JANUARY 26, 2018

WHERE: TIERNAN HALL 373

TIME: 2:30PM

GUEST SPEAKER

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TOPIC

Fluorescence Microscopy for Enhanced Understanding of Polymer Materials

ABSTRACT

In recent years, fluorescence microscopy techniques including single-molecule tracking (SMT) and confocal fluorescence microscopy have been realized as useful tools to probe the morphologies and physicochemical properties of both synthetic and natural polymer materials. In this presentation, I first introduce my past graduate studies to understand the properties of individual nanoscale block copolymer microdomains using SMT. I record the diffusive motions of individual sulforhodamine B (SRB) probe molecules incorporated into elongated microdomains in cylinder-forming polystyrene-*block*-poly(ethylene oxide) films. The trajectories obtained from one-dimensionally diffusing molecules provide a means to measure the diffusion coefficients and diffusion directions of single molecules, which correspond to the permeability and orientation of individual SRB-incorporated microdomains, respectively. SMT and fluorescence recovery after photobleaching measurements at identical µm-wide areas allow for the verification of the ergodicity in single-molecule and ensemble-averaged diffusion behaviors with minimum influence of material heterogeneity. Next, I describe my current postdoctoral studies aiming to understand the microstructure-mechanics relationship of collagen fiber networks using simultaneous confocal fluorescence microscopy and rheology. This method allows collagen gelation to be monitored at high spatial and temporal resolution while clarifying how structure sets viscoelasticity through the sol-gel transition. Furthermore, confocal rheology was employed to probe the shear-induced deformation of collagen fiber network, revealing fiber stretching, bending and breaking as a function of applied strain. These fluorescence techniques offer enhanced understanding of polymer structures under ambient conditions that will be relevant to the engineering of novel polymer materials suitable for future technological applications.

Committee members:
Dr. Nancy Jackson, Dr. Mengyan Li, Dr. Som Mitra