DREXEL UNIVERSITY
Materials Science and Engineering
College of Engineering

Department of Materials Science and Engineering
Ph.D. Thesis Proposal

Wednesday, December 19th, 2018 (10 AM-11 AM)
Bossone 302 Conference Room

RAFT and ROMP for macroscale polymer networks with enhanced structural and mechanical tailorability

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Factors such as mechanical strength, scalable synthesis, and cost still limit the industrial-scale use of many high-performance polymeric and non-polymeric materials in separations-based technologies. Beyond molecular-based separations relevant to climate change, the need for well-controlled modularity in polymer networks is an ongoing challenge that extends to many other areas including biomedicine, soft electronics, actuation, and additive-manufacturing.

Macromolecular polymer networks (MPNs), or polymer networks derived themselves from macroscale polymeric building blocks, are a relatively new class of material desired for their high degree of chemical and structural tailorability. This thesis shall explore the synthesis, characterization, and structure-property relationships of three new MPNs. Well-defined polymer building blocks will be synthesized using reversible addition-fragmentation transfer (RAFT) and ring-opening metathesis polymerization (ROMP). RAFT and ROMP will be shown to enhance MPNs by contributing precise chemistries, tunable molecular weights, dimensional control, and low dispersities to network structure. Second, this research will establish a fundamental understanding of how tunable structural parameters correlate to MPN morphology (homogeneity, pore size, porosity, surface area, crosslink density, molecular weight between crosslinks) and aim to determine the impact on key network properties (mechanical, rheological, swelling). Ultimately, this work will contribute a fundamental understanding of how MPNs would perform as modular materials for molecular-separation based applications.