

Microstructured Polymers Program

The next generation of polymer-based materials will rely on the incorporation of multiple components to achieve superior and tunable properties. This will require control over chemical connectivity and morphology from the nanometer up to the micron scale. Applications include, but are by no means limited to: multilayer and barrier films, water-compatible structures and processing, biorenewable materials, anisotropic mechanical and transport properties, nanoporous materials and templates, and ionic membranes. The thermodynamic incompatibility of most polymer pairs demands a flexible strategy for designing hybrid materials in both equilibrium and metastable structures. Block polymers exemplify such a strategy, as they offer direct routes to manipulating morphology, establishing the desired microstructural length scales, reinforcing interfacial properties, and incorporating diverse chemical and physical functionality. Efficient development of such materials requires parallel advances in molecular design and synthesis, prediction and characterization of microstructure, understanding of dynamics and processing, and property optimization. Our combined expertise in all of these areas, coupled with an unmatched suite of characterization facilities and a uniquely collaborative approach, position us to make major contributions to both fundamental research and technological practice.

Principal Investigators and their primary areas of expertise:

[Chris Ellison](#) Program Leader (CEMS): Composites, thin films, lithography, fibers, photopolymerization, and processing

[Frank Bates](#) (CEMS): Synthesis, thermodynamics, morphology, and transport

[Kevin Dorfman](#) (CEMS): Modeling, confined polymers, and DNA

[Marc Hillmyer](#) (CHEM): Synthesis, functionalization, and characterization

[Timothy Lodge](#) (CHEM & CEMS): Diffusion, scattering, characterization, and viscoelasticity

[Mahesh Mahanthappa](#) (CEMS): Synthesis, microstructural characterization, physical properties, and applications of block copolymers

[Chris Macosko](#) (CEMS): Processing, compatibilization, and rheology

[David Morse](#) (CEMS): Theory of complex fluids

[Theresa Reineke](#) (CHEM): Synthetic design, chemical characterization, biological novel macromolecules

Representative Current Projects:

Improved biorenewable polymers, Polymers in ionic liquids, New fluorinated polymers and copolymers, Controlled vesicles and wormlike micelles, Porous polymer nanostructures, Viscoelasticity of stiff chain polymers, Multilayer coextrusion and adhesion, Phase behavior of copolymer solutions, Reactive compatibilization, Phase behavior of ABC and multiblock copolymers, Inorganic/organic nanocomposites, Flow orientation of microstructures, Dynamics of polymer blends, Multiply continuous morphologies

Key Facilities:

[Polymer Synthesis Facility](#)

[Polymer Characterization Facility](#)

Contact:

To learn more about the Microstructured Polymers Program and [IPRIME](#), contact Bob Lewis, Executive Director, at 612.625.1269 or boblewis@umn.edu. Also, please visit the IPRIME website at www.iprime.umn.edu.