High Throughput Approaches to Polymer Science using Microreactor Technology

Kathryn L. Beers and Eric J. Amis

Polymers Division
National Institute of Standards and Technology
Gaithersburg, MD USA

Advanced polymeric materials in applications as diverse as tissue engineering, electronics and personal care products require superior control of a wide range of properties. From molecular properties such as molar mass and chain composition, to the properties of complex mixtures, high throughput and combinatorial techniques are providing researchers access to enormous libraries en route to both improved fundamental understanding of structure-property relationships and better products. The appeal of microreactor technology to this scientific community is three-fold: further reduction of scale in expensive specialty applications; faster, less expensive process integration in laboratory-scale investigations of complex, multi-step manufacturing protocols; and potential discovery of new and improved products from the unique microreaction environment.

The technical mission of the NIST Combinatorial Methods Center (NCMC) has two key components: development of new library fabrication techniques and commensurate high throughput and combinatorial measurement methods. Microfluidic device fabrication methods were designed to facilitate rapid redesign and fast in-house production of the chips. Our recent work demonstrates three basic routes to using the micro-environment to prepare both gradient and discrete polymer libraries from radical polymerizations. These routes, in addition to several commensurate measurement methods and the potential transformative impact of this technology will be discussed.