

Diversifying Polymer Properties through Precision Microstructure Engineering

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Abstract: The material properties of polymers are strongly influenced by their microstructures, such as monomer sequence, architecture, and tacticity. This presentation introduces various precision synthesis methods to access microstructure-engineered homopolymers and copolymers with diversified properties. The presenter will first report the recent progress in his research group on the controlled synthesis and characterization of multicomponent bottlebrush block copolymers containing sequence-defined side chains. Hierarchically assembled nanostructures were constructed with broadly tunable characteristic lengths. The concept of precision synthesis will then be extended to the preparation of (hyper)branched polymers in the second part of the presentation. A site-specifically initiated living branching polymerization with controlled degree of branching was realized through a polymerization-induced radical generation process. Kinetic modeling and mechanistic studies were carried out to enhance the scalability and versatility of the branching polymerization. Finally, a bimetallic molecular catalyst used for stereocontrolled living radical polymerization will be introduced. The impact of backbone stereoregularity on the thermomechanical and thermo-responsive properties of the prepared polymers will be discussed.