

Design and Synthesis of Novel Polymers: Bottom-Up and Top-Down Approaches

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Abstract

Based on the establishments of fundamental polymeric structure-property relationships through molecular dynamics simulations and model polymer experiments, next generation polymers can now be designed and synthesized. In this talk, two distinctly different approaches will be discussed. One is the bottom-up discovery to identify preferred structures and compositions of polyolefins based on linear higher alpha olefin monomers provided from ethylene oligomerization reactors using abundant and inexpensive ethane-cracked ethylene. These new polyolefins are new-to-the-world designed bottlebrush polyolefins synthesized by organometallic coordinated insertion polymerization through organometallic catalyst discoveries and syntheses. The other is the top-down searches for ultraviolet (UV) alignment polyimide materials for liquid crystal displays based on defined processability and performance requirements. This involves preparing polyimide solutions containing multiple polyimides and/or polyamic acids, and solvents where all components are selected and designed with specific functions. Subsequently, this leads to the design and synthesis of specific UV alignment aromatic diamine monomers and bridging aliphatic cyclic dianhydride monomers and the control of condensation polymerization process for preferred backbone sequence distributions.