Sequence of Monomers and Position of Stereocenters Matter for Thermal Properties of Stereocontrolled Oligourethanes

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Polyurethanes are commodity materials used for multiple applications. In recent years, a new category of polyurethane material has emerged, characterized by the lack of polymer molar mass dispersity, control of the monomer arrangement in the chain, and even full stereocontrol. Various multistep synthesis strategies have been developed to fabricate sequence-defined polyurethanes. However, synthesizing stereocontrolled polyurethanes with a controlled sequence is still a challenge. Polyurethanes with structural precision, as represented by biopolymers, i. e. proteins or nucleic acids, have opened new application directions for these groups of materials. It has been shown that polyurethanes can be used as biomimetics, information carriers, molecular tags, and materials with strictly controlled properties. Precise synthesis of macromolecules allows us to fine-tune the properties of polymers to specific needs. Therefore, it is essential to collect information on the sequence-structure relationship of polymers. In our work, we present synthetic pathways to make sequence and stereo-defined oligourethanes. We demonstrate that structural details, i. e., the monomer sequences and position of the stereocenter, have a tremendous effect on the thermal properties of model oligourethanes. We show that the introduction of chirality by constitutional isomerization can be used to program the thermal characteristics of polymers, which are key features for material applications.

Słowa kluczowe

sequence-defined polymers, stereocontrolled polymers, polyurethanes, thermal analysis, glass transition temperature