MACROMOLECULAR MATERIAL DESIGN VIA MODULAR SYNTHETIC STRATEGIES

Christopher Barner-Kowollik

Preparative Macromolecular Chemistry, Institut für Technische Chemie und Polymerchemie, Karlsruhe Institute of Technology (KIT), Engesserstr. 18, 76128 Karlsruhe, Germany.
christopher.barner-kowollik@kit.edu

ABSTRACT

The present lecture will describe how modular synthetic strategies in polymer chemistry can be employed to not only construct highly defined complex macromolecular architectures, yet also be used in applications reaching from bonding/debonding on demand networks to nano-porous materials. The specific chemistries to be addressed include fast, quantitative and mild ligation via (hetero) Diels-Alder chemistries, mechanistic switches from living radical protocols (RAFT) to ring opening polymerization producing sulfur free architectures as well as the use of efficient photo-chemistries to ligate variable enes and dienes in a spatially resolved fashion. It will be demonstrated how the reversibility of pericyclic reactions can be employed to periodically alter the physical characteristics of macromolecular materials with regard to intrinsic viscosity, color, configuration as well as micro- and nano-structure. The modification of nano-objects – including fullerenes and carbon-nanotubes – via pericyclic reactions will additionally be addressed. Moreover, the use of modular ligation for the build-up of highly defined α,ω-H-orthogonal-donor/acceptor systems for single chain assembly will be highlighted. Time permitting, the use of nitrones as control and ligation agents will be explored. The synthetic efforts will be underpinned by the in-depth characterization of the obtained macromolecules via hyphenated techniques including SEC-ESI-MS^n and LACCC-SEC.