

Polymer Chemistry

Undergraduate 3 credit course in Polymer Engineering curriculum

Amirkabir University of Technology

Chapter 1: Introduction (introductory concepts and definitions, classification of polymers based on polymer structure, classification of polymers based on polymerization mechanism, polymer architecture, copolymers, molecular weight and molecular weight distribution of polymers, tacticity in polymers, polymerization techniques, polymerization reactors, plastics elastomers and fibers).

Chapter 2: Step polymerization (reactivity of functional groups, external-catalyzed polymerization, self-catalyzed polymerization, accessibility of functional groups, equilibrium considerations, cyclization reactions, control of molecular weight, interchange reactions, process conditions, multichain polymerization, crosslinking, step copolymerization, commercial polymers, miscellaneous topics).

Chapter 3: Radical chain polymerization (nature of radical polymerization, structural arrangement of monomer units, sequence of events, rate of polymerization, initiation reactions, initiator efficiency, molecular weight, chain transfer reactions, inhibition and retardation, depolymerization, autoacceleration, process conditions, living radical polymerization, synthesis of commercial polymers).

Chapter 4: Ionic chain polymerization and coordination polymerization (comparison of ionic and radical polymerization, cationic polymerization, initiation reactions, chain transfer and termination reactions, effect of reaction medium, living cationic polymerization, rate of polymerization and molecular weight, anionic polymerization, initiation reactions, termination and side reactions, effect of reaction medium, synthesis of block and other polymer architectures, stereoisomerism in polymers, forces of stereoregulation in alkene polymerizations, effect of coordination, polymerization with Ziegler-Natta catalyst, polymerization with metallocene catalyst, commercial applications).

Chapter 5: Chain copolymerization (general considerations, copolymer composition, types of copolymerization behavior, variation of copolymer composition with conversion, effect of reaction conditions on radical copolymerization, reactivity in radical copolymerization, ionic copolymerization, synthesis of block and graft copolymers, commercial applications).

References:

1. G. Odian, "Principles of Polymerization" John Wiley & Sons: 2004.
2. P. C. Hiemenz and T. P. Lodge, "Polymer Chemistry" CRC press: 2015.
3. B. M. Mandal, "Fundamentals of Polymerization" World Scientific: 2013.
4. D. A. Schlüter; C. Hawker and J. Sakamoto, "Synthesis of Polymers: New Structures and Methods" John Wiley & Sons: 2012.