

Preface

Billions of pounds of polyolefins are produced annually. Through a simple insertion reaction, inexpensive and abundant olefins are transformed into polymeric materials for a wide range of applications, including plastics, fibers, and elastomers. Despite its long history, the polyolefin industry is continuing to grow steadily and remains technologically driven because of continuous discoveries of new catalysts, processes, and applications. The key technology that continues to drive the polyolefin industry is transition metal catalyzed polymerization. The discovery of the Ziegler–Natta catalysts in the 1950s not only revolutionized polyolefin production, but also catalyzed the development of the entire organometallic chemistry field. The next milestone in olefin polymerization catalysis was the development of metallocene catalysts in the 1980s. Whereas the Ziegler–Natta and metallocene catalysts remain as the workhorse in the polyolefin industry, the last decade has witnessed a number of major breakthroughs in the development of non-metallocene catalysts, including late transition metal catalysts for olefin polymerizations. These new systems show many exciting features, including high catalytic efficiency, excellent control of polyolefin stereoregularity and branching topology, and most excitingly the tolerance and incorporation of functional olefins.

This volume highlights some of the most important discoveries that have occurred recently in both early and late transition metal olefin polymerization catalysis. In Part A, a number of important developments in early transition metal catalysts for olefin polymerization are presented. Examples include the design of new metallocene catalysts for improved stereospecific polymerization, non-metallocene early transition metal catalysts, and the combination of different catalysts for efficient design of new polymer architectures. Part B highlights some important advancements in the development of late transition metal catalysts for olefin polymerization. Late transition metal catalysts offer important and unique features that early transition metal catalyst systems do not possess, such as the ability to control polymer branching topology and tolerance and incorporation of polar functional olefins. In addition to metal-coordinated insertion polymerizations, the recent development of late transition metal complexes for living/controlled radical polymerizations is also highlighted in the end.

This volume is not intended to provide a comprehensive review of all the important developments in olefin polymerization catalysis in recent years; instead, it highlights a representative series of important examples in this area. I am extremely grateful to the experts who have contributed by writing a chapter and hope this volume will be helpful to researchers, teachers, and students interested in organometallic and polymerization chemistry.

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