

Preface

Olefin polymerization using transition-metal catalysts has revolutionized materials science and petroleum industry, and created an affluent society worldwide. Thus, the discovery of ethylene polymerization under low pressure using Ziegler-Natta catalysts should be ranked among the most important discoveries of the past century. Research on a homogeneous version of olefin polymerization catalysts, represented by metallocene catalysts, took off in the 1980s, which resulted in additional progress in polymer science and technology as well as in related research fields. The catalysts composed of transition metal complexes have enabled controlled synthesis of a number of polyolefins and olefin copolymers with the proper choice of an auxiliary ligand for the molecular transition-metal complex. The structures of the above-mentioned molecular catalysts can be easily modified, which improves the reactivity and selectivity of olefin polymerization. Another important achievement in the use of molecular transition metal complexes as catalysts is the elucidation of the reaction mechanism of olefin polymerization. The exact reaction pathways and detailed account of the stereocontrol of such polymerization can be discussed on the basis of the catalyst structure and polymerization results. Organotransition-metal chemistry has developed together with coordination polymerization because its fundamental reactions, including the migratory insertion and β -hydrogen elimination of olefins, play key roles in polymerization catalyzed by transition-metal complexes. Progress in research on coordination polymerization continues to generate new polymer materials from olefins that are economically and environmentally favorable.

This issue of Lecture Note Series contains eight articles covering the polymerization using various organotransition-metal catalysts, including early- and late- transition-metal complexes, new trends in olefin oligomerization, and related reactions. All the authors have ensured that their article includes the historical and scientific backgrounds of the field, current research progress, and further scope of research. The whole book is designed to deliver eight independent lectures from the authors. Since the authors involved are well versed in organometallic chemistry, the discussion in each chapter is based on a profound understanding of the reactions and structures of organotransition-metal complexes. A few topics overlap among the chapters so that the readers may choose to start reading particular chapters in the book first. We included two final chapters on olefin metathesis and cross-coupling polymerization. These two reactions are composed of fundamental

reactions of organotransition-metal complexes, similar to the coordination polymerization, and at present have become crucial materials science and device technology.

The project of publishing this book in its present form started with an invitation from Springer Publishing to contribute to the series “Lecture Notes in Chemistry”. We would like to acknowledge the initiative of Dr. Tien-Yau Luh, editor of the series of books, and the kind cooperation of Elizabeth Hawkins in bringing this book to fruition.

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Organometallic Reactions and Polymerization

Osakada, K. (Ed.)

2014, X, 301 p. 268 illus., 23 illus. in color., Hardcover

ISBN: 978-3-662-43538-0