Fundamentals of Organometallic Catalysis

This book is a translation of the second German edition of *Grundlagen der metallorganischen Komplexkatalyse* by Dirk Steinborn (Martin-Luther-Universität Halle-Wittenberg). Unlike many works on catalysis published by Wiley-VCH, this is a textbook aimed at undergraduate, graduate, and PhD students. Before starting my review, I should mention that as an author of a textbook in this area (*Homogeneous Catalysis: Understanding the Art*, Springer, **2004**), of which an update is due, it was tempting to write a comparative review, but I have tried not to do so!

The book starts with three introductory chapters. Chapter 1 summarizes the history of research on catalysis, and the early attempts are described in detail and explained well. Chapter 2, also rather short, deals with the principles of organometallic catalysis, that is to say the definitions of catalytic cycles, catalyst activity, mechanistic studies, etc. The catalytic systems are drawn throughout as cycles, which for a kinetic analysis may easily lead to mistakes. A few definitions can be simplified, for example "*If all steps are reversible, the expected turnover cannot be greater than that permitted by the individual equilibria*" could be replaced by "*The overall thermodynamics dictate the conversion that can be achieved*."

In the history of the development of organometallic catalysis, and also later in the respective chapters, the author shows how large the contribution of German chemists has been to the exploration of the area and, in addition, he pays tribute to the many Nobel Prize winners in catalysis. Except for the inventions of the last two decades, most inventions originate from industry or applied research institutes.

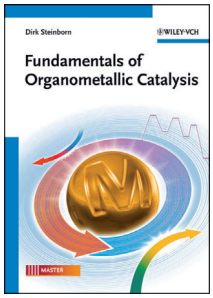
Chapter 3 deals with the elementary steps in organometallic reactions that are needed to analyze the catalytic processes. The possible reaction pathways are clearly outlined; letters and numbers in the figures are referred to in the text, thereby resulting in an accurate presentation (in the classroom this is trouble-free to achieve, but on paper not always easy!). One may disagree on some minor points: For example, the oxidative addition of methyl iodide to rhodium is called nucleophilic substitution; I would say that the nucleophilic substitution is the intimate mechanism, but overall the reaction remains an oxidative addition. The valence state of a metal in a metallacyclopropane will only be known after we have obtained the details of the X-ray structure; I would rather stick to a formal definition, adding that in practice we have a gliding scale to reach the other extremes. Of the many definitions given in this chapter, not everything is used later on. In asymmetric hydrogenation, the annotations *re* and *si* side are used, but for trisubstituted alkenes both C atoms should be designated (or one should mention which one is referred to).

The chapters that follow from the introductory chapters present the details of the usual reactions: hydrogenation, hydroformylation, carbonylation, metathesis, oligomerization, polymerization, C–C cross-coupling, addition of HCN, hydrosilanes, and amines to alkenes, and oxidation of alkenes and alkanes. The cross-coupling chapter focuses on C–C bond formation, with the result that the Hartwig–Buchwald coupling is completely missing, as are C–N/C–O/C–S coupling reactions in general. For the name reactions, I would prefer the complete names, i.e. Heck–Mizoroki, Kumada–Corriu, and Suzuki–Miyaura, to be used in a textbook.

Two chapters are devoted to less-common topics, diene oligomerization and nitrogen fixation. The chapters on oxidation and nitrogen fixation do not concern "organometallic" catalysts, but in view of the similarity to organometallic catalysis their inclusion is obvious. The chapter on hydroformylation contains some information about Fischer–Tropsch synthesis and the chapter on nitrogen fixation includes a description of the commercial heterogeneous systems as well as the biochemical nitrogen fixation, which very nicely links the three areas of catalysis.

As explained in one of these introductory chapters, the abundant DFT schemes should be used in a "qualitative way". For a nine-step reaction, such a scheme, with all the precautions that should be taken, is neither very informative nor accessible for a student. Overall a thermodynamic approach, or a rough comparison of the steps (e.g. insertion of CO versus insertions of alkenes), seems more didactic to me.

The material is presented in four ways: in the main text supported by figures, background information intercalated in the text, exercises and their solutions, and in footnotes. In addition, a large number of references and further reading is presented. An extensive index completes the book. The chapters usually start with an introductory description, followed by a more detailed treatment. Once this is realized, the reader will appreciate this set-up; for example, I very much liked the clear introduction to the polymerization of olefins. The exercises are often based on recent literature examples and the elaboration is very detailed. Many students may not be able to work out the exercises as they are not that easy. In my opinion, essential material is presented in background sections, footnotes, and exercises. The book con-



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tains a wealth of material, but a student will have to work through all the material to catch all of the basic concepts. Studied in this way, the book will aid the development of a new generation of experts in homogeneous catalysis.

A criticism also concerns the appearance of the book; as usual for Wiley books, the font is very small, but in the footnotes I could not distinguish between "C_{sp^2}" and "C_{sp^3}"! Moreover, the pages are rather shiny, which makes the book difficult to read. As a further disadvantage, the book is only in black and white; for a textbook, the occasional use of color would be advantageous and I understand that cost-wise this is hardly an issue. The price of the paperback issue, however, makes this textbook worth considering.

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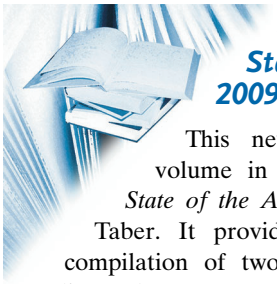

Organic Synthesis: State of the Art 2007–2009

This new book is the third volume in the *Organic Synthesis: State of the Art* series by Douglass F. Taber. It provides the reader with a compilation of two years of the popular online column, *Organic Chemistry Highlights*. The author's weekly column is now a well-established reference offering a brief overview and perspective of a selected research highlights.

Following the successful concept used in the previous books of the series, this new volume features 104 entries posted online on the "organic-chemistry.org" website between 2007 and 2009. The book includes a cumulative reaction and author indices of all three volumes. The layout of the table of contents has improved since the previous versions as the various columns have been organized by topics and it provides the reader with a better overview of the areas covered.

From a content point of view, this book is divided in to two main themes. The first part covers a wide range of topics, from the C–H functionalization to the organocatalytic construction of C–C rings. Each column describes a specific aspect of a topic on two pages using a selection of papers that have had significant impact in their respective areas. The highlighted articles are described by a concise scheme and a brief summary. References are conveniently inserted in the main text allowing easy access to more detailed information on a particular transformation. Many columns include direct applications of the various methodologies to the synthesis of biologically relevant targets.

The second part of the book is devoted entirely to new classics in total synthesis. Over 20 total syntheses are presented using the same two pages format. In each case, Professor Taber gives a brief description about the target and a succinct overview of the successful strategies that were envisioned by the authors. Following this introduction, the synthesis is presented by focusing on the key transformations and bond constructs.

Overall, this book was an enjoyable read and will prove useful to both students in organic chemistry and to scholars who want to keep up-to-date with the vast volume of articles published monthly. The volume of this series, and those that will follow, provide a useful insight into the evolution of the field of organic synthesis and, as such, they are a valuable resource that can be used as a reference and as a source of new inspiration.

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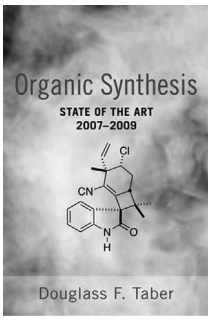

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