

## Book reviews

### **Ferrocenes, Homogeneous Catalysis, Organic Synthesis and Materials Science**

A. Togni and T. Hayashi (eds)  
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It is with great pleasure that those of us who have worked in iron-group metallocene chemistry welcome an entire book dedicated to the subject. In the preface pains are taken to point out that the book is not comprehensive—nor could it be, given that there are, on average, 15–20 publications per week on the subject currently.

In Part 1 on homogeneous catalysis, some 93 pages are dedicated to the synthesis and reaction chemistry of bis-diphenylphosphinoferrocene, arguably the most important ferrocene-based ligand. The treatment begins from a historical perspective, then jumps quickly to lengthy tables on the  $^{31}\text{P}$  NMR shifts of various bis-diphenylphosphinoferrocene complexes, on the coordination mode, and on ligand conformation. The section on catalysis deals with the now well-known transition-metal catalysed processes in which bis-diphenylphosphinoferrocene has been used as a ligand: organoelement cross-couplings, carbonylation, nucleophilic substances, olefin hydrogenation, hydrosilylation and hydroformylation, etc. These subsections read more as a review article than a steadily progressed narrative and therefore will be of interest to those with a keen interest in these specialized areas. The summary describes the chapter as 'the tip of the iceberg of what could be done with 1,1-bisdiphenylphosphinoferrocene' which is modest indeed for such a comprehensive treatment. What is lacking is a comparison between the coordination and reaction chemistry of bis-diphenylphosphinoferrocene and other related ligands, which can be dramatic (to say the least).

The second chapter deals with asymmetric catalysis and is written by Hayashi himself in what is an authoritative article by the person most highly regarded in this area. The material reads smoothly, beginning in the familiar style developed by Kumada and Hayashi in the late 1970s. The wide range of structural modifications that have been made on aminophosphinoferrocenes are covered here. This chapter will interest the synthetic organic chemist since it highlights those areas of catalysis in which chiral ferrocene-based complexes excel.

The third chapter deals with enantioselective dialkylzinc addition to aldehydes mediated by chiral ferrocenylamino alcohols. Again, this is a comprehensive article written in this case with a more personalized approach. The section is easy to read and follow, and will be of interest to the wider community of organic chemists with specialist interest in this area of catalysis.

Part 2 of the book begins with an introduction to

chiral ferrocene derivatives by Wagner and Herrman, and documents what are now standard synthetic procedures. This chapter is ideal for those students who require a thorough grounding in the nomenclature and general preparation chemistry of ferrocene. Details are given of the early works on resolution of ferrocenylamines by Ugi, through to one-step asymmetric synthesis methodologies from readily available precursors. It is unfortunate that there is considerable overlap with the previous chapter since much of the chemistry of chiral ferrocenylamines is common to both sections. This is followed by a chapter on ferrocene compounds which contain heteroelements; this is a broad-ranging section and the focus is on ferrocene chalcogen-containing compounds, after some basic organic chemistry of substituted metallocenes. Macrocyclic and cryptand-containing ferrocenes, an extremely important synthetic area, are covered by C.D. Hall; the focus is on synthetic methodology and product characterization. Again, this is a useful review chapter for those interested in potential chemical sensor research. The chapter on electrochemistry and structural characterization is by an active worker in the area, and is, therefore a topical overview. It was a particularly difficult section to write because of the vast amount of data available, and is therefore highly selective. However, a balanced view is achieved.

The final part of the book deals with materials science, covering charge-transfer complexes and the related magnetic materials, ferrocene-containing liquid crystals and ferrocene-containing polymers. This part is the most disappointing, not because of the contents, which are treated very well by all the authors involved, but because of the omission of large sections of work on ferrocenes such as redox-active complexes. The chapter on ferrocene-containing thermotropic liquid crystals by Deschenaux and Goodby is concise and provides excellent coverage. Finally, the coverage of ferrocene-containing polymers, ranging from conventional ferrocene-containing polymers to the topical ring-opening of heteroatom-bridged ferrocenes, is to the point and provides the necessary background for post-graduates engaged in this research area.

Overall, this book provides a good coverage of many of the important research topics which use ferrocene as a key component. The weakest point of the book is the repetition of some areas of work in which it is perceived as fashionable to work. This is unavoidable since presumably the contributions were prepared independently. A copy should be in any research library for general consultation. It also provides useful insights for the organic chemist interested in the selection of ferrocene-based ligand-containing catalysts. For those of us who have worked in the area for a considerable time, it will be only too easy to direct students to this book for a basic grounding in ferrocene chemistry.

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