

**Titanium and Zirconium in Organic Synthesis;** Edited by Ilan Marek; Wiley-VCH: Weinheim, 2002, 538 pp, hardback, \$ 165; ISBN 3-527-30428-2

Whereas methylenation of carbonyl moieties with the Tebbe reagent and hydrozirconation of unsaturated bonds are extensively utilised within the organic community, many of the other potential applications of titanium- and zirconium-based organometallics remain largely unknown. This edited book seeks to bring to the attention of organic chemists the wide scope of these types of reagents.

In the introductory chapter, Negishi and Huo give a highly comprehensive overview of zirconocene derivatives. Their categorisation of reactivity patterns of such reagents provides an excellent reference tool. In chapter 2, Takahashi and Li explore, in a readable fashion, the preparation and break-down of zirconacyclopentadienes. In chapter 3, written by Dixon and Whitby, insertions of carbenoids (1-lithio-1-halo derivatives) into organozirconium species are well explained. Chapter 4, by Lipshutz, Pfeiffer, Noson and Tomioka describes hydrozirconation using the Schwartz reagent and the multitude of subsequent reactions that may be performed on the intermediate organozirconium species. Applications of such chemistry to natural product synthesis are clearly detailed. The fifth chapter discusses the exciting results obtained with acylzirconocenes as nucleophilic (umpolung) sources of acyl moieties. Hanzawa does justice to this subject with useful mechanistic diagrams. Hoveyda then tackles the topic of enantioselection using zirconium catalysts, exploring a plethora of reactivities, from allylations of aldehydes to Mannich reactions to Diels–Alder cycloadditions. In many cases, these reactions are objectively compared with non-zirconium alternatives. A variety of little-utilised *gem*-metallozirconocenes are described by Dembitsky and Srebnik in chapter 7, with Al, B, Li, Sn, Ga, Ge, Zn and Zr as the metallo partners. The focus is on their preparation but methods for further

elaboration are also included. Chapter 8, by Suzuki, Hintermann and Yamanoi, clearly discusses cationic zirconocenes, generally made by Ag(I) activation of a zirconocene-halide reagent, which have had several applications, including as glycosylation agents. The diversity of reactions achievable with user-friendly titanium(II) alkoxides is explained in chapter 9 by Sato and Urabe, followed by the fairly new field of bis(trimethylsilyl)acetylene zirconocene and titanocene complexes in chapter 10 (by Rosenthal and Burkalov). Another specific topic follows in chapter 11 by de Meijere, Kozhushkov and Savchenko: the preparation of cyclopropanols and their amine counterparts using titanium, with applications of such products in synthesis being highlighted. The focus in Chapter 12 is very much on organic transformations of epoxides, particularly their titanocene-catalysed ring opening reactions and variations on that theme. Penultimately, Szymoniak and Moise present an interesting review of allyltitanium reagents. Finally, chapter 14 by Takeda discusses olefin metathesis using the Tebbe reagent and related species.

Despite the inevitable differences in author writing styles between the chapters, Marek has brought them together in a remarkably uniform and refreshingly error-free way. In particular, the section divisions are systematic and descriptive, allowing the reader to search the content pages for their subject of interest. Furthermore, the indexing is accurate and thorough. Many of the chapters end with sample experimental procedures, which give the reader an idea of the types of techniques involved in such chemistry. The references are extensive and reasonably up-to-date. As a reference tool, this book is very thorough and I would recommend purchase by any library serving organic chemists and by the researchers themselves.

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