

Book reviews

Transition Metals for Organic Synthesis: Building Blocks for Fine Chemicals

Matthias Beller and Carsten Bolm (eds)

Wiley–VCH, Weinheim, 1998

Two-volume set: Vol. 1, 577 pages, Vol. 2, 455 pages.
£275

ISBN 3-527-29501-1

It is virtually impossible for the modern-day practitioner of organic synthesis to be unaware of the vast host of transition-metal-based reactions which are now at his disposal, and the ambitious aim of the editors of this two-volume set is to portray the current state-of-the-art in terms of applications for organic synthesis and fine chemicals production. The individual chapters have been prepared by over 150 selected international experts and the result is an excellent overview of the subject which is ideal both for browsing and for searching specific topics. Emphasis is given to the most recent developments within each area and those transition-metal-based reactions which are most often used.

The final selection and organization provide the reader with a very clear impression not only of the rapid pace of development of reactions using transition metals but also of their exciting potential in the future, especially in enantioselective transformations.

The first volume is devoted to methods for the construction of carbon–carbon bonds and the stage is appropriately set in the opening chapters by Trost and Keim which highlight the basic aspects and advantages of transition metals, both from the academic perspective and for industrial fine chemicals synthesis. A second section which focuses on catalytic reactions includes excellent chapters on such fundamental reactions as hydroformylation, hydrocarboxylation, carbonylation and hydrocyanation as well as more sophisticated reactions for fine chemicals such as cyclopropanation, alkyne cyclomerization, palladium-catalysed allylic substitution, alkene metathesis and isomerization, and intramolecular hydroacylation.

The wide variety of cross-coupling reactions, including the Suzuki, Stille and Heck reactions, are also well covered, as is the use of lanthanides as Lewis acid catalysts. Although less attractive from an industrial standpoint, stoichiometric metal-based reactions are then covered in a third section which highlights recent progress in the use of samarium(II), chromium(II) and manganese(III) reagents for redox-induced carbon–carbon bond formation as well as the use of organozinc reagents and vanadium and low-valent titanium in the McMurry and Petasis reactions. Important advances in carbometallation, the use of iron acyl and diene

complexes, arene chromium tricarbonyl complexes and the Pauson–Khand reaction are also featured and certainly challenge the reader to the future potential of discovering catalytic variants.

The second volume concentrates on reduction and oxidation reactions. The commercially valuable homogeneous asymmetric hydrogenation of enamides, imines and carbonyl groups for the production of enantiopure building blocks is treated extensively and the chapters on the practicalities of heterogeneous hydrogenation, transfer hydrogenation and hydrosilylation are especially valuable. The wider topic of oxidation ranges through C–H activation of saturated hydrocarbons and controlled allylic oxidations using palladium and copper catalysis to the range of useful functional group transforms which can be performed on alkenes, where the reader can select from such key reactions as asymmetric epoxidation, dihydroxylation, aminohydroxylation, hydroamination and the Wacker oxidation. This volume closes with a ‘pot-pourri’ of special topics which includes the uses of ultrasound, photocatalysis, pressure, microwaves, and two-phase systems with transition metals.

As the editors themselves state at the outset, it is impossible to provide a comprehensive coverage of this vast subject area, and it is inevitable that some of the selected expert authors have tended to concentrate on the work from their own laboratories, while others have provided a more extensive coverage. Nevertheless, on balance, it must be said that the editors have achieved their stated objective of portraying an exciting and dynamic picture of the important metal-mediated reactions used in modern-day organic synthesis. The two volumes provide a veritable feast of over 1000 pages which not only highlight the magnificent achievements made in recent times but also provide young researchers with challenges and inspiration for the invention of new transition-metal-based reactions in the future.

Both volumes contain a wealth of information and would be a worthy addition to any academic or industrial library concerned with atom-efficient and stereo-controlled organic synthesis.

W. B. MOTHERWELL
University College, London, UK