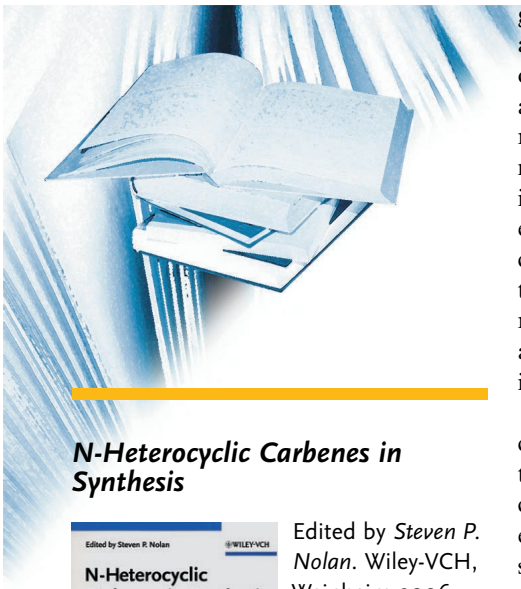
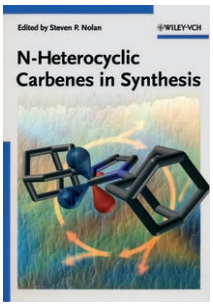


N-Heterocyclic Carbenes in Synthesis



Edited by *Steven P. Nolan*. Wiley-VCH, Weinheim 2006. 304 pp., hardcover € 139.00.—ISBN 978-3-527-31400-3

Starting with the first isolation of a crystalline N-heterocyclic carbene (NHC) by Arduengo in 1991, this family of nitrogen-containing heterocycles, which had previously received little attention, has now become an important class of ligands. The introduction of these compounds as ligands for transition-metal complexes has led to great advances in catalysis, as is impressively illustrated by the use of NHC-ruthenium complexes (e.g., Grubbs second generation) for olefin metathesis. These catalysts display much higher stability and reactivity compared to the parent phosphine-based complexes. The still rapidly growing interest in these NHC compounds can be attributed not only to their differences from phosphine ligands, but also to their similarities. Apart from their important roles in transition-metal catalysis, both phosphines and NHCs have also proven to be highly versatile organocatalysts, albeit based on different mechanisms. This emphasizes that NHC compounds are not merely "phosphine mimics", but are important in their own right.

This new monograph, edited by Steven P. Nolan, provides a broad overview and discussion of this very rapidly growing research area, and covers aspects that range from catalyst developments to more specialized topics such as Pd-NHC-catalyzed telomerization reactions and the use of NHCs as metal-free organic catalysts. The book is up-to-date, as the literature coverage extends to the end of 2005 and in some cases also to 2006. However, because of the rapid pace of developments, some recent exciting advances (e.g., in the area of organocatalysis) could not be included.

The book comprises 12 independent chapters written by leading experts in the respective areas. A typical chapter consists of roughly 25 pages, and deals either with a reaction type or with the specialized chemistry of NCH complexes of a particular transition metal. In some cases the authors have decided to highlight their own important contributions, while also describing seminal work by other groups.

The first chapter, by S. Beligny and S. Blechert, is devoted to NCH-ruthenium complexes and their important role in olefin metathesis. The authors provide a well-balanced and instructive overview of this vast topic. After a short introduction on the mechanistic principles and a description of the improvements and differences in metathesis with Ru-NHC catalysts, the chapter discusses the structural diversity of Ru-NHC complexes and the corresponding differences in catalytic performance. The promising topic of enantioselective Ru-catalyzed metathesis is briefly illustrated by some examples. The last part of the chapter describes different approaches to immobilization in the form of solid-supported Ru-NHC complexes.

Chapter 2, by M. K. Whittlesey and co-authors, is entitled "Ru NHC complexes in Organic Transformations (Excluding Metathesis)". That is an accurate description of the first part of the chapter, which deals with hydrogenation, hydrosilylation, and isomerization reactions. However, in the second part, which is devoted to tandem reactions, the authors digress from their stated intention by describing sequential reactions that contain a metathesis step.

In Chapters 3 and 4, transformations catalyzed by Pd-NHC complexes are described. Chapter 3, written by the editor and co-workers, gives a concise overview of $(NHC)Pd^{0}$ and $(NHC)Pd^{II}$ complexes and their catalytic activity in various cross-coupling reactions. However, although they do not come within the scope of this and the following chapters, it needs to be mentioned that some important (NHC)Pd-mediated cross-coupling reactions (Kumada, Negishi, and Sonogashira reactions, etc.) are not covered in this book. The following chapter, which also deals with NHC-palladium catalysts, concentrates on telomerization and aryl amination reactions, both of which are of importance for industrial applications. In the context of a monograph that is intended for a broad readership, this chapter, the longest in the book, could be criticized as containing too much detailed information.

Chapters 5 and 6 deal with the more specialized topics of NHC ligands for oxidation reactions and Pt^{0} complexes for selective hydrosilylation reactions. An insight into the unique properties of NHC ligands for oxidations is given, followed by a detailed mechanism-based discussion about Pt-catalyzed hydrosilylation reactions, which is also instructive for nonspecialist readers with interests in other areas of NHC catalysis.

In Chapter 7, J. Louie gives a well-structured description of Ni-NHC-mediated catalysis, ranging from rearrangement reactions to cycloadditions and new developments in olefin polymerization.

The following chapters are devoted to structural properties of NHC ligands. The focus of Chapter 8 is the development of chiral N-heterocyclic carbenes and their applications in asymmetric synthesis. Although the chapter gives a good overview of the different possible elements of chirality, known structures, and reactions, this review could have been made even more useful by additionally including information about reactions on which the ligands have been tested and the maximum *ee* values achieved in the overview section. Chapter 9 provides some useful theoretical background, as well as important details for the preparation of chelate and pincer carbene complexes.

Hydrogenation reactions using iridium complexes are the main topic of

Chapter 10, but the chapter suffers a little from a lack of consistency in the presentation. Chapter 11 deals with the less familiar chemistry of coinage metal NHC complexes and their role in catalysis, and also discusses the special role of Ag-NHC complexes in the preparation of other metal-carbene complexes.

The monograph concludes with a "metal-free" chapter, which deals with NHCs as highly versatile organocatalysts. The authors provide an overview of different types of catalysts, methods for their preparation, and their reactive properties. A large part of the chapter deals with transesterification reactions, and the related important topic of living ring-opening polymerizations, which implicates some omissions in other fields. It would have been useful also to give the nonspecialist reader more background information on the many different mechanisms that are described; for example, their similarities could be pointed out.

To summarize, this book can be recommended for all who have an interest in N-heterocyclic carbenes and their versatile chemistry. Even though the book does not cover all possible applications and structural features, Steven P. Nolan has delivered a well-written monograph that sheds light on the great diversity and potential developments of this rapidly growing research area.

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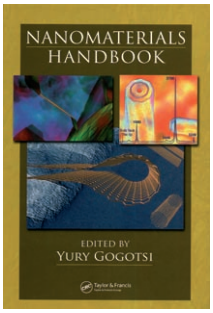
DOI: 10.1002/anie.200685468

Nanomaterials Handbook



Edited by *Yury Gogotsi*. CRC Press/Taylor & Francis, Boca Raton 2006. 792 pp., hardcover $ 149.95.—ISBN 0-8493-2308-8

It is difficult to comment on the quality of a book that is written by 62 different authors and consists of 27 chapters. On the other hand, it must also have been difficult for the editor to put together a sufficiently comprehensive collection of information on nanomaterials, including preparation methods, properties, and applications, to form a work deserving the title *Nanomaterials Handbook*. The editor has collected a large number of review-type articles from scientists working on different aspects of nanoscience to achieve this goal, and it has indeed worked out very well. The topics are not randomly chosen but somehow related to each other. Also, in most cases the research results reported by the contributors extend well beyond their own research. Furthermore, the layout is attractive and the figures and graphics are well reproduced, resulting in a book that is very pleasant to read.

After a few introductory chapters, the editor devotes about the first third of the book to carbon nanomaterials. The topics covered in these first eight chapters include various aspects of fullerenes, carbon nanotubes, carbon whiskers, nanodiamonds, and carbides. This is followed by just a few chapters (100 pages) on one-dimensional inorganic nanostructures, including semiconductors, oxides, and boron nitrides. The following seven chapters deal with physical and structural properties in complex nanomaterials, and cover topics such as melting and sintering, elastic properties of nanolayers, grain boundaries, and structural stability. The last third of the book consists of eight chapters that discuss technological applications based on the special properties of nanoscale materials. Here the reader can learn how nanofibers or nanoporous materials are made, and how nanomaterials can be used in composites, for drug delivery, and in devices such as field emission displays and electrochemical cells. In the latter part, the applications discussed are again mainly based on carbon materials.

Each chapter starts with a table of contents, which is followed by a short abstract and a short introduction to the particular field. This is a big advantage for the reader, who gets an initial overview of the topic and an impression of what the chapter contains. On average the chapters are 20 pages in length and contain about 100 references. In total the book contains an impressive number of more than 2500 references, which shows the enormous increase of scientific interest in nanomaterials, and surely justifies its collection in the present form. As is usual in a book that consists of a collection of review-type articles, there are no cross-references, but the editor has provided an index with more than 1000 keywords to guide the reader to the desired topics.

In summary, the book covers fundamental physical and technological aspects of nanomaterials. It is not a handbook in the classical sense, with tables systematically listing materials properties and methods of characterization. Instead, it shows the current state of research in various areas of nanoscience by presenting a selection of recent results. As the main emphasis is on carbon materials, it is mainly suitable for scientists or engineers who want to get a broad overview or collection of recent research in this area.

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