

Handbook of Grignard Reagents

G. S. Silverman and P. E. Rakita (eds)

Marcel Dekker, New York, 1996

736 pages. \$225

ISBN 0-8247-9545-8

Grignard reagents are of course among the most familiar of organometallic compounds, being covered by elementary as well as advanced textbooks on organic and organometallic chemistry. They continue to be of great academic interest: exactly how does magnesium react with an organic halide, and what species are present in the resulting solution or suspension? They also have important applications — hence the interest of this book to readers of this journal; not only are they important reagents for laboratory-scale organic and organometallic syntheses, but such syntheses are widely used on an industrial scale.

On the positive side, this book contains a tremendous amount of useful information, some of which is not readily available from other sources. On the other hand, the information is not always easy to locate, it is sometimes not presented in a systematic and balanced manner, and there are some surprising omissions. A fundamental weakness is that the book comprises 34 self-contained chapters, by 29 different contributors, with very little cross-referencing, some overlap, and wide variation in depth of treatment. Some assistance is given to the reader by the detailed table of contents, but the index is almost useless.

Part I of the book is a brief Introduction. Part II covers methods of Grignard preparation, including 'traditional' methods, preparations from olefins and acetylenes (by hydrometallation, carbometallation, reactions of dienes with magnesium, etc.) and magnesium activation. Part III is a useful chapter on safe handling practices for industrial Grignard reagents (but without reference to the hazards of metallic magnesium). Part IV covers analyses of Grignard reagents: wet analyses (but there is no reference to the useful Gilman qualitative tests), infrared and Raman spectroscopy, nuclear magnetic resonance and crystal structures. Part V, on mechanisms and structure–reactivity relationships, is very unbalanced. The review on mechanisms of Grignard reagent formation by Hamdouchi and Walborsky is detailed and authoritative, but at 73 pages it is out of proportion with good, but much shorter and inevitably less-detailed, accounts of mechanisms of carbonyl addition and related reactions, structure–reactivity relationships, and the Schlenk equilibrium and its effect on reactivity; then there is a full chapter on the effect of tris(pyrazolyl)hydroborato ligation — interesting, but scarcely mainstream.

The least satisfactory part of the book is Part VI, on general reactions of Grignard reagents. While some of the chapters are good, on the one hand there is too much overlap (for example, between the chapter on nucleophilic addition to unconjugated carbon–carbon multiple bonds

and the one in Part II, referred to above, covering carbometallation); on the other hand, in several chapters the subjects are covered so sketchily as to be uninformative or even misleading. For example, anyone inexperienced in the area, and seeking information on reactions of Grignard reagents with nitriles, would be given no hint of the potential complications of these reactions from the mere half-page devoted to the subject.

Finally, Part VII comprises reviews, generally of a high standard, but again very uneven in terms of length and depth of coverage, on special topics: the Barbier reaction; Grignard reagents as bases; S_N2 versus S_N2' (reactions of allylic compounds, etc.); alkynyl Grignard reagents and their uses; Grignard reagents and silanes; Ziegler–Natta catalysis; and organomagnesium compounds as polymerization initiators.

Anyone hoping to find in this *Handbook of Grignard Reagents* a worthy successor to Kharasch and Reinmuth's classic *Grignard Reactions of Nonmetallic Substances* will be disappointed, and it cannot be recommended as an introduction to the subject. However, it does contain some excellent reviews, and specialists in the area will find it useful to have them collected together.

One final grumble: why, in a book costing \$225, can the publisher not ensure that the structural formulae are of good quality and in a uniform style?

B. J. WAKEFIELD

*Ultrafine Chemicals, Manchester***Principles of Process Research and Chemical Development in the Pharmaceutical Industry**
O. Repič

John Wiley & Sons, Chichester, 1998

xvi + 213 pages. Hard cover £60

ISBN 0-471-16516-6

This book is about process and development chemistry — essential topics linking medicinal chemistry with industrial scale-up in the pharmaceutical industry.

The author starts and ends the book with two very important themes in process chemistry. Firstly, the reader is introduced to the safety and economics of industrial scale-up with poignant examples demonstrating that the judicious choice of solvents, catalysts and reaction conditions can markedly influence both the economics and safety of all reactions.

Subsequent chapters cover important considerations in scale-up. These include understanding and troubleshooting impurity profiles and by-product generation, and guidelines for successful asymmetric synthesis taking a known hypocholesteremic agent as an example. This chapter contains examples of organosilicon and organoboron intermediates. Practical methods such as prefer-

ential crystallization and chromatography to resolve enantiomers are also covered. Other chapters describe the use of enantiopure building blocks in the construction of the optically pure final compound and the radio-synthesis of compounds such as ^{14}C -labelled clozapine and fluvastatin for use in elucidating their fate *in vivo*.

The book finishes with a chapter on perhaps some of the most contentious topics in the pharmaceutical industry today: process validation; good manufacturing practice; and the road to the overall goal of process and development chemistry, which is the attainment of government approval to manufacture a drug.

The text is richly illustrated throughout with practical examples and case studies based on the author's own experience of many years in the pharmaceutical industry, although there are only a few examples involving organometallic compounds. The author writes lucidly with a clear enthusiasm for the subject. This book opens up the area between medicinal and industrial chemistry and should appeal to any chemist with a fundamental interest in pharmaceutical development.

TREVOR WRIGHT

Current Drugs Ltd, London

Chemistry of the Elements, 2nd edn
N. N. Greenwood and A. Earnshaw
Butterworth-Heinemann, Oxford, 1997
340 pages. £35.00 (paperback)
ISBN 0-7506-3365-4

This reviewer has to admit at the outset that 'Greenwood and Earnshaw' is one of his favourite, full-scale, inorganic texts. In my hands, the first edition proved wide-ranging, up-to-date and user-friendly enough for 'chalk-face' activity with undergraduates, and yet it was still a sufficiently impressive resource to be used in lecture preparation. So I liked it. It should then be said that the second edition continues the good work of the first, without a dramatic increase of size, and should be acquired by all serious chemistry undergraduates and graduate students (and inorganic chemistry staff). I think it is good value for money. I do not think the book is aimed at the populist undergraduate market; although it is well presented, no colour is used and the form of the diagrams is pretty basic (although clear). It may not appeal greatly to the CD ROM-, soundbite-oriented student as it is fairly traditional in style, and indeed it neither comes with nor makes any reference to, use of student-centred material. However, it is still excellent and (praise indeed?) a 1950–1960s student would probably think it an essential possession. I hope our 1990s students also come to this view; I shall do my best to help.

Readers of *Applied Organometallic Chemistry* will

want to know more of the book's treatment of the organometallic area. As might be expected, it is done in a traditional Periodic Group manner, with one overview chapter oriented to the transition elements. Page coverage is distributed as follows: Group 1 (5), Group 2 (9), Group 3 excluding B (11), Group 4 (6 + 10), Group 5 (8). Transition metals receive similar cover to the earlier Groups (1, 4, 3, 3), with greater detail being reserved for the heavier elements: Group 7 (8), Group 8 (9), Group 9 (5), Group 10 (6 pages).

As an introduction to organometallic chemistry for undergraduates in a general programme of chemistry, this book is very good. Students carrying out an organometallic project will need more detailed source material. Postgraduates in organometallic chemistry will need it as a 'grammar' of the subject. The industrial processes are generally covered, but as it is not the purpose of this work to act as an encyclopaedia, treatments are brief.

So, all chemists should buy this new edition, and use it.

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Applications of Organometallic Compounds

Iwao Omae
Wiley, Chichester, 1998
vii + 518 pages. £85
ISBN 0 471 97604 0

Iwao Omae will be known to organometallic chemists for his books on *Organometallic Intramolecular-Coordination Compounds* (Elsevier, 1986) and *Organotin Chemistry* (Elsevier, 1989). The present book is based on reviews of the organic compounds of 20 metals which appeared in *Kagaku Kogyo (Chemical Industry)* between 1990 and 1996.

The book is wider in scope than the title suggests. After a short introductory section, and a chapter on the history of organometallic chemistry, each of the remaining 20 chapters covers one specific metal. A description of the extraction of the metal from the ore is followed by an account of the preparation, structures and properties of its organometallic compounds. The chapter then ends with a survey of the applications of these compounds in organic synthesis and in medicine, agriculture and industry.

There has been some updating of the articles, but this could have been more thorough and there are few references later than 1994. Thus, for example, although there is extensive referencing to Wilkinson, Stone and Abel's first edition of *Comprehensive Organometallic Chemistry* (Pergamon, 1982) there is none to the second edition (Elsevier, 1995) which has two volumes devoted to organometallics in synthesis. Again, some books which I would regard as classics are not mentioned, such as