Book Reviews

Methoden der Organischen Chemie (Houben-Weyl), 4th Edition, Volume IV/1c, Reduktion, Part I, H. Kropf, volume editor, A. W. Frahm, J. Lehmann, W. Meise, H. Muth, P. Pachaly, E. Reimann, H.-J. Rimek, M. Sauerbier, P. Tinapp, and F. Zymalkowski, volume authors. 1980. xxxi + 912 pages, DM 780. Volume IV/1d, Reduktion, Part II, H. Kropf, volume editor, J. Bracht, A. Hajós, P. Hartter, H. Muth and M. Sauerbier, volume authors. 1981. xliii + 1000 pages. DM 860. Georg Thieme Verlag, Stuttgart/New York.

Reduction is one of the key processes in organic chemistry, and we have here nearly 2000 pages devoted to all aspects of the reduction of organic compounds. The Houben-Weyl series, we remind the reader, is complementary to the Beilstein handbook. The properties of individual organic compounds are not given here; rather the Houben-Weyl volumes focus on the *chemistry—what* has been done and *how* it was done. The chemistry is brought systematically and critically in well-organized discussions that are very thorough and which are backed up by an abundance of references to the original and the review literature. Both text and many tables bring a wealth of information. Detailed experimental procedures from the literature also are provided. There are many equations and figures, and these will be helpful to the reader.

Volume IV/1c covers catalytic hydrogenation in all its many aspects. A 90-page section brings general discussions of heterogeneous and homogeneous catalytic hydrogenation, catalytic transfer hydrogenation, and the stereochemistry of catalytic hydrogenations. The applications of various metal catalyst systems, all of which are familiar to the organometallic chemist, are discussed in the section devoted to homogeneous catalysis: chromium carbonyl complexes, pentacyanocobaltate(II), dicobalt octacarbonyl $(Ph_3P)_3RuCl_2$, $(Ph_3P)_3RhCl$, and other rhodium complexes, iridium complexes, including $(Ph_3P)_2Ir(CO)Cl$, $H_2PtCl_6/SnCl_2$, $(\eta^5\text{-}C_5H_5)_2Ti(CO)_2$, and soluble Ziegler catalysts. Here, as is usual in the Houben-Weyl series, the emphasis is on practical aspects of the chemistry to the almost complete exclusion of mechanistic considerations. So there is no mention of the catalytic cycles involved in which organometallic intermediates play an important role. Nonetheless, for the organic chemist whose aim is the hydrogenation of a given organic compound these general sections will be useful and informative. However, it is the following sections which provide the really useful information for the synthetic organic chemist: over 450 pages in which the applications of catalytic hydrogenation are detailed in a discussion which is organized according to the organic functions which are reduced.

Volume IV/1c concludes with the first two sections of the chapter on reductions with inorganic reducing agents. The remaining three sections of this chapter are found in Volume IV/1d. Included in this chapter are the following inorganic reducing agents: nonmetal compounds (I^-, HI, $S_2O_4^{2-}$, N_2H_4, $(RO)_3P$, H_3PO_2, etc.); metals; simple and complex metal hydrides; metal salts (Sn(II), Ti(II), Ti(III), V(II), Cr(II), etc.) and metal carbonyls; so there is much organometallic chemistry in this chapter. (This will not be apparent to the uninformed reader since, as noted before, mechanisms are not discussed.) Further chapters in Volume IV/1d deal with the few examples of reductions using organometallic compounds as reducing agents, with electrochemical reductions, and with biochemical reductions which utilize microorganisms.

In each chapter, as in the first, the discussion is organized in terms of the organic functions which are reduced. However, the chapters usually begin with a general discussion of the applications of the class of reducing agents being covered, including brief accounts of the preparations of these reagents.

Each volume contains an author index and a compound index. The latter is organized in seven categories, each of these alphabetically. This index, together with the very detailed table of contents, allows one to find just about anything one might be looking for. For the chemical public at large it is unfortunate that this outstanding, definitive account of reduction in organic chemistry is written in German, not in English. The Houben-Weyl series is now nearly complete; however, since the earliest volumes date from the 1950s, it may be hoped that supplementary volumes will be issued to bring the topics covered earlier up-to-date. If this done, we hope that Houben-Weyl will follow the lead of Beilstein and Gmelin and bring out such books in English.

The price of these volumes largely precludes individual ownership. However, all academic, industrial, government chemistry libraries should have these excellent books on their shelves.

Dietmar Seyferth, *Massachusetts Institute of Technology*

Handbook of High Resolution Multinuclear NMR. By C. Brevard and P. Granger. John Wiley and Sons, New York. 1981. xvii + 229 pages. $24.50.

This handbook is divided into two parts. Part One (four chapters, 77 pages) includes a chapter on NMR parameters (i.e., sensitivity, receptivity, chemical shifts, coupling constants, relaxation times, and relaxation mechanisms), a chapter on the Fourier transform method (the rotating frame, pulse angles, the free induction decay, the digitalization process, and display of the spectrum), a chapter on the nuts and bolts of spectrum acquisition (sample preparation, lock systems, references, spectral manipulations, decoupling procedures, special pulse sequences, sensitivity enhancement, and resolution enhancement), and finally a chapter concerning dynamic measurements (T_1 and T_2 measurements and spin-locking measurements).

The book has been printed from a typescript but the layout and format are in general readable although some figure captions tend to run into the text. Typographical errors are not excessive. The book is exactly as the title states—a handbook. The four chapters provide a compilation of information, and without a knowledge of basic NMR theory and spectrometers, this section of the book will not be of great utility. Chapter 3 which is entitled "Spectrum Recording" is probably the most useful chapter. For example, helpful information concerning the correction which must be made when sample and lock substances are different is given. A section of FID and spectrum manipulations (e.g., left shifting the FID or zero filling the beginning of the FID to correct base line distortion) as well as a section on special pulse sequences is well-done. One disappointment of a book of this type on multinuclear NMR is that although 87 of 116 magnetically active isotopes have a nuclear spin value I greater than $^1/_2$, nowhere is there a section dealing with multiplet intensities which result when the coupled nucleus does not have $I = {}^1/_2$. It does not appear to be generally well-known that these intensities are different for each value of I.

Part Two of this book is entitled "Isotope NMR Fingerprints" and is a handy compilation to have at one's fingertips. Nuclei are listed in increasing atomic number and for each nucleus one finds a listing of the spin, natural abundance, receptivity relative to ^{13}C, gyromagnetic ratio, quadrupole moment (if applicable), and the resonance frequency in a field corresponding to exactly 100 MHz for Me_4Si protons. In addition the spectrum of a test sample (compound, solvent, concentration, lock, and temperature are given) with its relevant acquisition and processing parameters is shown. A chemical shift scale is shown, and typical coupling

constant and relaxation time values are listed. Several references are then given. A close examination of several nuclei revealed some problems. For example, only one value of a $^{11}B-^{11}B$ coupling constant (18.9 Hz) is given while literature values of J_{BB} range from 12 to 106 Hz. A remark under ^{77}Se states that no NOE is observed except when a proton is directly bound to Se. All relaxation studies to date have shown essentially no contribution to T_1 from the dipole–dipole mechanism even when Se–H bonds are present. Also, in the chemical shift scale figure for tin, Sn(IV) is listed for three different classes of compounds although it is fairly obvious that Sn(VI) and Sn(V) should be listed.

This book will not compete with "Practical NMR Spectroscopy" by Martin, Delpuech, and Martin or with "NMR and the Periodic Table" by Harris and Mann, but any laboratory doing multinuclear NMR will find it useful.

J. D. Odom, *University of South Carolina*

Gmelin Handbook of Inorganic Chemistry. 8th Edition. Fe, Organoiron Compounds. Part C3, Binuclear Compounds 3. G. Dettlaf, U. Krüerke, N. Kuhn, and M. Mirbach, volume authors, U. Krüerke, volume editor. 1980. ii + 196 pages. DM 456, $269.10. Organoiron Compounds, Part C4, Binuclear Compounds 4. U. Krüerke, N. Kuhn, E. Luther, M. Mirbach, and B. Wöbke, volume authors, U. Krüerke, volume editor. 1981. ii + 285 pages. DM 787, $374.70. Gmelin Institut für Anorganische Chemie der Max-Planck-Gesellschaft zur Förderung der Wissenschaften and Springer-Verlag, Berlin/Heidelberg/New York.

These volumes are the latest additions to the Gmelin organoiron series which now numbers 15 volumes. In Part C3 are included dinuclear iron compounds with organic ligands bonded by four carbon atoms (mostly acyclic and cyclic dienes), with or without Fe–Fe bonds and dinuclear iron compounds containing one or two η^5-C_5H_5 ligands. The treatment of the latter class is continued and concluded in Part C4. A great diversity of organoiron compounds is found in these books, and the empirical formula and ligand formula indexes at the end of each volume will be indispensible to the user. The way the iron atoms are connected in these dinuclear complexes varies widely: direct Fe–Fe bonds and single bridges and double bridges of all kinds. Among the dinuclear η^5-C_5H_5Fe complexes, $[\eta^5\text{-}C_5H_5Fe(CO)_2]_2$ has received much attention, and 86 pages are devoted to this compound and to others containing alkyl and other substituents on the C_5 ligand. In Part C3, among the complexes with L^4 ligands, the ferracyclopentadiene complexes of type $C_4R_4Fe_2(CO)_6$ play an important role, with many known examples of this class.

The presentation of the many different types of dinuclear iron compounds, many with complex structures, is greatly helped by the many formulas and figures. All available data for each compound are provided, either in text or tables: preparation, physical and spectroscopic properties, structure, and chemical conversions, along with the pertinent references. These include citations of the original literature, reviews, theses, conference reports, and a few patents, through the end of 1977 for Part C3 and the end of 1978 for Part C4. A few later references have been added.

For anyone working in the area of organoiron chemistry these books, as well as the rest of the Gmelin organoiron series, will be very useful indeed. They provide a wealth of information and are as exhaustive in their coverage as "Chemical Abstratcts" permits, and they are well organized and up-to-date. A final volume in which the remaining dinuclear iron compounds are treated, those with organic ligands bonded to Fe through six or more carbon atoms, will conclude the "C" series.

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Advances in Catalysis. Volume 28. Edited by D. D. Eley, H. Pines, and P. B. Weisz. Academic Press, New York. 1979. x + 403 pages. $52.00.

This recent volume of Advances in Catalysis contains chapters by T. Engel and G. Ertl, "Elementary Steps in the Catalytic Oxidation of Carbon Monoxide on Platinum Metals", by R. Eisenberg and D. E. Hendriksen, "The Binding and Activation of CO, CO_2 and NO and Their Homogeneously Catalyzed Reactions", by M. I. Temkin, "The Kinetics of Some Industrial Heterogeneous Catalytic Reactions", by S. M. Csicsery, "Metal-Catalyzed Dehydrocyclization of Alkylaromatics", and by J. J. Villafranca and F. M. Raushel, "Metalloenzyme Catalysis".

It is often true that a review significantly reflects the vantage point and background of the reviewer—and the present is no exception. For this reviewer the gem of the volume is the article by Csicsery, surveying an important but as yet little recognized area of hydrocarbon chemistry, the cyclization reactions of alkylaromatics which lie at or just beyond the gasoline boiling range. Although somewhat documentary (rather than interpretive or projective) in nature, the article clearly surveys an area which (in my view) has not yet received the attention it merits within the industry.

Three chapters deal with reactions of small molecules, CO, CO_2, NO, NH_3, and the like, each directed at a distinct audience. The article by Engel and Ertl catalogs, in considerable detail, the state-of-the-art in CO adsorption and oxidation on Pt-group metal surfaces; Eisenberg and Hendriksen write for a general audience in their somewhat elementary overview chapter on reactive inorganic complexes of CO, CO_2, and NO; and Temkin seeks the engineering community in his kinetic analysis of reaction rates.

At the other extreme in complexity is the brief but very specific and very up-to-date review by Villafranca and Raushel on catalysis by three metalloenzymes: thermolysin, a Zn- and Ca-containing peptidase; yeast hexokinase, catalyzing reaction between hexose and MgATP; and glutamine synthetase, which requires divalent cations such as Mn^{2+}.

Overall Volume 28 of Advances in Catalysis is characterized by authors of recognized ability and by a wide breadth of subject material, ranging from highly analytical chapters on small molecule conversion and synthesis to the provocative articles on dehydrocyclization and on metalloenzymes.

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Aspects of Homogeneous Catalysis. Volume 4. Edited by R. Ugo. D. Reidel Publishing Co., Dordrecht. 1981. viii + 204 pages. $58.00, Dfl. 110.

This is the fourth volume of a series which is concerned with different areas of homogenous catalysis. The previous volumes have contained some useful reviews and the present one continues in this tradition.

The first chapter, by Sheldon, is on the metal-catalyzed epoxidation of olefins with hydroperoxides. It is a thorough treatment of this reaction with emphasis on the application of molybdenum [e.g. $Mo(CO)_6$] and vanadium [e.g., $VO(acac)_2$] compounds as catalysts. This reaction is the basis for the Halcon process (industrial preparation of propylene oxide).

There is a brief (28 pages) chapter by Mestroni, Camus, and Zassinovich on the homogeneous catalytic reduction of carbonyl, azomethine (i.e., Schiff bases), and nitro groups. This chapter is plagued by a number of typographical errors and word omissions and by a superficial mechanistic discussion, the latter being limited to the carbonyl reduction reaction.

The use of (η^3-allyl)metal complexes for the catalysis of diolefin reactions is examined in detail by Julémont and Teyssié. A valuable part of this contribution is the discussion of polymerization processes. This is the only chapter which cites papers published in 1980. Unfortunately, there are a number of printing errors, and incorrect grammar is used on occasion (e.g., p 115, "The stereospecific polymerization of conjugated dienes ... has been early related to η^3-allylic-M_T intermediates").

The last chapter of this voluem, by Markó and Bakos, consists of tabular lists of chiral phosphines and substrates (mainly olefinic) in rhodium complex catalyzed asymmetric hydrogenation. It is a useful compilation.

In summary, Volume 4 will be of interest to organic and inorganic chemists, particularly those working on metal complex catalyzed reactions of olefins.

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