Book Reviews *

Ziegler Catalysts: Recent Scientific Innovations and Technological Improvements. Edited by G. Fink (Max-Planck-Institute), R. Mülhaupt (Albert-Ludwigs-University), and H. H. Brintzinger (University of Konstanz). Springer: New York. 1995. xiii + 511 pp. $133.00. ISBN 0-387-58225-8.

This monograph delineates the contributions from a symposium entitled 40 Years Ziegler Catalyst, held September 1−3, 1993, in Freiburg, Germany. The book is divided into twenty-nine chapters covering a broad spectrum of topics from Ziegler's initial discovery to the state-of-the-art "single-site" catalysts currently being studied by many academic and industrial groups. The co-authors are too numerous to mention (>110 total) suffice to say they are widely considered leaders in their respective fields of study. Many references from the early 1990s are included but are obviously limited by the date of the original symposium.

Chapter 1 provides a historical account of Karl Ziegler's research from the early 1920s to his olefin polymerization discovery of 1953. Included in this chapter is a discussion of the "nickel effect", the initial observation which gave rise to Ziegler catalysts. Chapter 2 addresses the issue of patent rights in the polyolefin industry. A few of the legal battles that ensued are chronicled, suggesting most companies recognized the enormity of this discovery at the time. An overview of the development of Ziegler catalysts from 1953 to 1993 is presented in Chapter 3. A detailed survey of the synthesis, structure, and characterization of methylaluminoxane (MAO) is outlined in Chapter 4. Given the impact MAO has had on the development of single-site catalysts, this chapter was certainly warranted. Eight sections are dedicated to heterogeneous olefin polymerization; in particular, a variety of magnesium chloride-supported catalysts are discussed. These high-activity or "high-mileage" catalysts have significantly improved the efficiency of the polymerization process. No less than fifteen chapters are concerned with the development of single-site catalysts and the impact they have had on the academic and industrial community. Missing from this impressive list of works is a dedicated chapter dealing with group 4 cyclopentadienylamide or "constrained geometry" catalysts. The unique ability of these compounds to affect the copolymerization of ethylene and 1-alkenes was well established in 1993 and should have been included. Appropriately, several chapters deal with theoretical calculations on single-site species. These studies provide yet another tool available for the design of new catalysts. Three chapters are concerned with recent advances in ring-opening metathesis polymerization (ROMP), carbon monoxide−olefin copolymerization, and acetylene polymerization, respectively.

Overall, this monograph does a good job of addressing the ever-expanding field of Ziegler catalysis. The subjects covered should be appealing to both academic and industrial groups. The subject index, author index, 267 figures, and 124 tables are informative and complete.

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The Chemistry of Organophosphorus Compounds. Volume 4. Ter- and Quinquevalent Phosphorus Acids and their Derivatives. The Chemistry of Functional Group Series. Edited by Frank R. Hartley (Cranfield University, Cranfield, U.K.). Wiley: New York. 1996. xiv + 995 pp. $375.00. ISBN 0-471-95706-2.

As part of the invaluable series on the chemistry of functional groups, this volume is fourth in a series on organophosphorus chemistry. It covers specifically the ter- and quinquevalent phosphorus acid derivatives, that is, phosphonates, phosphonic acids, phosphinates, and phosphinic acids, and their halogen derivatives R_2PY, RPY_2, and $R_2P(X)Y_2$, where Y = halogen and X = O, S, or Se. Ten chapters are presented in this volume on the following topics: (1) The preparation and properties of tervalent phosphorus acid derivatives (O. Dahl, 45 pp, 232 references); (2) The synthesis of phosphonic and phosphinic acids and their derivatives: non-functionalized acids (R. S. Edmundson, 97 pp, 660 references); (3) The synthesis of functionalized phosphinic and phosphonic acids and their derivatives. Part A: halo, hydroxy, epoxy, mercapto, carboxy and oxo functionalized acids (R. S. Edmundson, 153 pp, 1051 references); (4) The synthesis of functionalized phosphinic and phosphonic acids and their derivatives. Part B: diazo, nitro and amino functionalized acids (R. S. Edmundson, 103 pp, 616 references); (5) The synthesis and reactions of thio- and selenophosphonic and -phosphinic acids (R. S. Edmundson, 97 pp, 523 references); (6) Properties and reactions of phosphonic and phosphinic acid and their derivatives (R. S. Edmundson, 157 pp, 931 references); (7) Acyl phosphonates and their derivatives (E. Breuer, 76 pp, 231 references); (8) Gas-phase positive and negative ion chemistry of organophosphorus compounds via mass spectrometric techniques (R. A. J. O'Hair, 34 pp, 119 references); (9) Biological activity of phosphonic and phosphinic acids (A. Kalir and H. H. Kalir, 13 pp, 117 references); (10) The chemistry of organophosphorus chemical warfare agents (R. M. Black and J. M. Harrison, 59 pp, 227 references).

Overall, this volume is a great resource for synthetic chemists, whether they are phosphorus chemists or not. The first eight chapters deal mainly with the syntheses and reactions of these phosphorus acids and derivatives, covering the literature up until mid-1995. As seen from the number of references in the chapters, the various topics and aspects of the chemistry of these organophosphorus compounds are covered quite extensively. Most of the chapters are quite readable, even if packed with information, with good schemes and figures. Several chapters also include information regarding the handling and physical properties of the phosphorus compounds in question. This information can be invaluable to the practicing synthetic chemist, as certain phosphorus derivatives can be tricky to handle.

Chapter 1 begins with a very handy table of the names of representative phosphorus compounds (they can be quite confusing sometimes!). Chapters 2−6 are quite comprehensive and very well organized. The topics of bioactive organophosphorus compounds, phosphonoamino acids, chiral phosphorus compounds (chiral at P or on the carbon ligands), and thio and seleno derivatives are covered in good detail. Chapter 6 summarizes much of the chemistry mentioned in Chapters 3−5, but then presents in detail more of the reactivities of the compounds from these earlier chapters. Chapter 7 discusses the chemistry, bioactivities, and physical and spectroscopic properties of the interesting α-acyl phosphonates. In contrast to the earlier chapters, the chapter on the biological activity of these organophosphorus acids (Chapter 9) is definitely too short, and could be expanded greatly. This is a very interesting topic, and the main reason for much of the recent development in organophosphorus chemistry today. The last chapter on the use of organophosphorus compounds as chemical warfare agents is very timely. The inclusion of the syntheses of many of these nerve agents seemed at first disturbing, but on later retrospection, its benefit was acknowledged. Knowing the toxicity of compounds resulting from the use of certain ligands on phosphorus is a definite advantage for a practicing synthetic chemist. The chapter on ion chemistry of organophosphorus chemistry (Chapter 8) seems misplaced in this volume that deals mainly with synthetic and biological aspects of these compounds. Most of the mass spectral data in this chapter are also not from the title ter- and quinquevalent phosphorus acid compounds.

To reiterate, this book is of great value for the practicing phosphorus chemist, as well as for synthetic organic chemists. It contains chapters that are up-to-date and relevant reviews of the material covered. As with most published work, the book has its assortment of typos (including this reviewer's name!), misdrawn structures (such as OR−, instead of RO−), etc. These shortcomings are few, however. The text also contains an extensive Author Index, as well as a decent Subject

*Unsigned book reviews are by the Book Review Editor.

Index. While a bit pricey, this volume is a definite must for those in the field, and a great addition to any library.

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Synthetic Methods of Organometallic and Inorganic Chemistry. Vol. 1. Edited by W. A. Herrmann (Technische Universität München) and A. Salzer (Technische Hochschule Aachen). G. Thieme: Stuttgart, Germany. 1996. x + 182 pp. DM124.00. ISBN 3-13-103021-6.

The Handbuch der Präparativen Anorganischen Chemie, commonly called *Brauer* after the editor of the three editions of the "bible" of inorganic synthesis, is one of the most useful tools for synthetic inorganic chemists. Although the first two editions are available in English, I have used dog-eared photocopies of selected pages of the German third edition for years. Instead of a translation of the third edition, Herrmann and Salzer have assembled its successor, *Synthetic Methods of Organometallic and Inorganic Chemistry*, in English. Eight volumes, which will be released during 1996 and 1997, are organized according to the periodic table. The first volume, subtitled Literature, Laboratory Techniques and Common Starting Materials, consists of three chapters. Chapter 1, Inorganic and Organometallic Chemical Literature, is written by Salzer and includes extensive bibliographies. Chapter 2, Laboratory Techniques of Organometallic Chemistry, is also written by Salzer. It emphasizes practical, convenient bench-top Schlenk techniques for air-sensitive solids and septum techniques using syringes and cannulas for air-sensitive liquids. There is reasonable attention paid to the safe handling of potentially dangerous materials. The reader is referred to other books for glovebox and high-vacuum-line techniques; methods of solid-state synthesis are scarcely mentioned. Chapter 3, Commonly Used Starting Materials, consists of checked procedures from an international group of forty-nine contributors. Nearly half of the contributors are from Germany, with an emphasis on the "Mülheim school" of organometallic chemistry. Preparations include a few solid-state materials such as alkali-metal−graphite intercalation compounds, common ligands such as cyclopentadienylsodium, and many transition-metal complexes and compounds. This last group ranges from somewhat obscure ($Pt(MgCl)_2$) to very common ([Fe(η-C_5H_5)$(CO)_2$]$_2$). A few organic synthetic applications, such as coupling reactions using titanium reagents, are described. Sufficient detail is provided for researchers to duplicate most syntheses, although in a few cases ($Cr(CO)_3$ complexes of substituted benzaldehydes) the procedure is too vague to be useful. Each reader will quibble with some of the chosen methods. For example, the purification of C_{60} by chromatography on alumina with hexane/toluene is laborious and inefficient. In one case, Ta(η^5-C_5Me_5)Cl_4, three similar preparations are offered with yields ranging from 70% to 96%; the best method would have sufficed. I hope that such minor flaws and occasional typographical errors wil be corrected in later printings or editions. The overall worth of the volume lies in having a broad range of common materials collected together. Volume 1 will probably be the most common single-volume purchase, although the marketing emphasis is on purchasing the eight-volume set for about $850.

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Electrochemical Processes for Clean Technology. By Keith Scott (University of Newcastle). The Royal Society of Chemistry: Cambridge. 1995. xiii + 307 pp. $99.00. ISBN 0-85404-506-6.

This book effectively summarizes electrochemical technologies in the areas of synthesis, separations, and waste treatment. Other traditional areas such as electrical power storage and conversion, corrosion, and electroanalysis are not discussed in detail. Nearly all of the text will be understood by anyone with an undergraduate degree in physical science or engineering. Chapter 1 is an overview; it contains an interesting table that compares electrochemical separation and purification technologies to other conventional processes. Chapters 2−4 provide the readers with a brief overview of electrochemical cells, transport processes, and reactor cell design. These chapters will be especially useful to readers who are unfamiliar with electrochemistry. Chapter 4 provides background to those who are unfamiliar with engineering concepts associated with high-throughput cells. Chapter 5 reviews electrochemical membrane separations, i.e., electrodialysis, electroosmosis, etc. Chapters 6 and 7 contain an extensive overview of electrochemical processes for treatment of industrial process streams and wastes. These chapters are the most unique portion of the book. Chapter 8 covers organic and inorganic electrosynthesis. In general, Chapters 5−8 are all clearly written and contain many useful explanations and diagrams. Referencing is adequate but by no means exhaustive. An extremely useful aspect of these chapters is the numerous specific examples of how the various technologies have been applied. The examples contain reactor diagrams, conversion rates, and efficiencies as well as cost analyses in certain cases.

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Studies in Surface Science and Catalysis, #94: Catalysis by Microporous Materials. Edited by H. K. Beyer (Hungarian Academy of Sciences), H. G. Karge (Fritz Haber Institute), I. Kiricsi (Jozsef Attila University), and J. B. Nagy (University of Notre-Dame de la Paix). Elsevier: Amsterdam. 1995. xix + 792 pp. $291.25. ISBN 0-444-82049-3.

Proceedings of ZEOCAT '95, Szombathely, Hungary, July 9−13, 1995. ZEOCAT '95 is the eleventh in the series of symposia devoted to special fields of zeolite chemistry. Six plenary lectures and forty oral and forty-two poster presentations were included in the program. The accepted papers cover every aspect of catalysis on microporous materials. A significant number of the contributions describe the synthesis, modification, and instrumental and chemical characterization of zeolites and other micro- and mesoporous materials. Catalytic reactions involve hydrocarbon cracking, nucleophilic aromatic substitution, methanol to hydrocarbon conversion, hydration of acetylene, various alkylation reactions, redox transformations, Claisen rearrangement, etc.

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