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BOOK REVIEWS

Linker Strategies in Solid-Phase Organic Synthesis. Edited by Peter J. H. Scott (University of Michigan, Ann Arbor). John Wiley & Sons, Ltd.: Chichester. 2009. xxvii + 678 pp. $205. ISBN 978-0-470-51116-9.

Several books focused on solid-phase organic synthesis (SPOS) have been published in the past decade. Among these, the book edited by Kates and Albericio focuses on peptides, that by Seneci addresses libraries, and the volume by Dörwald concerns organic functional group organization. Against this backdrop, this book on linker strategies nicely fills an important niche. The 36 contributing authors have exceptional credentials in SPOS and, collectively, are informative and thorough in their coverage of the state of the art in linker strategies for this technique.

The first half of the book introduces SPOS organized by "traditional linker units". Newcomers to the field will find the seven chapters in this section useful for assessing the scope of SPOS. The second half of the book is focused on multifunctional linker units with applications in diversity-oriented synthesis, chemical genetics, and preparation of libraries of compounds. The last two chapters (21 and 22) cover fluorous linker units and solid-phase radiochemistry. With 36 contributing authors, there are variations in writing styles and formatting nuisances, but these are not overly distracting. The Foreword by Czarnik is a pleasant two-page read; he does a nice job of inviting the reader into the specifics covered in the book.

Chapters are generally composed of an introduction, an overview of linker units, linker applications and examples, and typical experimental procedures, as well as a conclusion. I estimate that ~40% of the text is taken up with figures and schemes. The aesthetics of these chemical diagrams is generally quite good; however the sizes of chemical structures are unnecessarily variable—often within a given chapter and certainly from chapter to chapter.

Referencing, while difficult to accurately quantify, appears to be thorough. Consider, for example, that Chapter 16 "Silicon and Germanium Linker Units" by Spivey and Diaper, although only 38 pages in length, has 130 references. Because each chapter is self-contained in its referencing, this means that several reviews are referenced multiple times.

The book concludes with an index that is intuitive and generally thorough and a preceding section entitled "Linker Selection Tables", which I found to be very useful. It is organized by linker—with structures provided—cleavage conditions, product, type—based on cleavage with acid, base, cyclative, multifunctional, photolabile, etc.—and chapter headings.

In summary, this book is a useful complement to literature reviews as well as other SPOS books. It will be a valuable resource for university libraries and an excellent first source for practitioners of solid-phase organic synthesis.

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Electrochemistry in Nonaqueous Solutions: Revised and Enlarged 2nd ed. By Kosuke Izutsu (Musashino, Japan). WILEY-VCH Verlag GmbH & Co. KGaA: Weinheim. 2009. xvi + 415 pp. $145. ISBN 978-3-527-32390-6.

Interest in nonaqueous electrolytes for electrochemical applications has grown tremendously over the past few decades. Water, although an exceptional solvent, has its limitations: organic materials are frequently poorly soluble in water; the electrochemical stability of aqueous electrolytes is severely limited relative to many organic solvents; the physical properties of water, e.g., T_m, T_b, vapor pressure, etc., often preclude its use; and water may be highly reactive with electrodes, current collectors, etc. The use of a nonaqueous solvent is a valuable alternative for both analytical and practical applications. For instance, the market for secondary lithium batteries was greater than $7 billion in 2009. These batteries, which are entirely dependent upon nonaqueous electrolytes, are the heart that pumps life into modern portable electronics and may, in the near future, aid in revolutionizing transportation through their use in plug-in hybrid electric (PHEV) and all electric vehicles.

The first two chapters of this book provide an overview of the properties of solvents, how they are classified, and a discussion regarding ion solvation. This is followed by two chapters covering acid—base and redox reactions in nonaqueous solvents. A more extensive discussion follows in the next chapter regarding electrochemical techniques. Subsequent chapters cover potentiometry (including a useful discussion regarding reference electrodes, pH measurements, liquid junction potential, etc.), conductimetry, polarography, and voltammetry in nonaqueous electrolytes. In the next chapter, the author briefly summarizes electrochemical—nonelectrochemical techniques such as spectroelectrochemistry, electrochemical ESR, electrochemical mass spectroscopy, the electrochemical quartz crystal microbalance, and scanning electrochemical microscopy. This is followed by chapters on the purification of solvents and the selection of salt-supporting electrolytes. The latter includes several pages detailing methods for the preparation/purification of tetraalkylammonium salts. Applications to lithium batteries, capacitors, electroluminescence, electrochemical reduction of CO_2, electrowinning/electrorefining, and electrodeposition are then covered.

Two new chapters have been added to the second edition: Chapter 13 "Electrochemistry in Clean Solvents" (although "Clean Solvents" is a poor selection of words for this title) and Chapter 14 "Electrochemistry at the Liquid—Liquid Interface". The former begins with a short discussion of the use of specialty solvents and green chemistry. Although the tenets of green chemistry are certainly worthy of mention, including this content is confusing because it covers the replacement of organic

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solvents by water, solvent-free systems, and immobilized solvents, none of which have a place in this text; this presumably was done to introduce the topics of supercritical fluids and ionic liquids. Certainly these have a role for specialized electrochemistry and perhaps even for practical applications, e.g, batteries, sensors, etc. The author, however, lauds the virtues of these materials without emphasizing their tremendous challenges. For example, there is nothing simple about working with supercritical fluids. The author mentions several times that ionic liquids have low toxicity but then does include a brief mention of toxicity toward the end of the chapter. Ionic liquids may in fact be highly toxic and certainly are costly. Impurities can plague their use for electrochemical applications; this is the case for other solvents too, but unlike molecular solvents, ionic liquids cannot be readily distilled on a large scale to achieve exceptional purity. The final chapter is a brief examination of liquid−liquid interfaces between two immiscible electrolytes (organic solvent/water) and ionic liquid−water mixtures (with "hydrophobic" ionic liquids).

This text is more of a survey of topics related to nonaqueous electrolytes and their employment for electrochemical methods than a comprehensive treatise. Other books, such as *Electrochemical Methods: Fundamentals and Applications* by Bard and Faulkner; *Nonaqueous Electrochemistry* edited by Aurbach; *Physical Chemistry of Electrolyte Solutions: Modern Aspects* edited by Baumgärtel, Franck, and Grünbein; *Electrodeposition from Ionic Liquids* edited by Endres, MacFarlane, and Abbott; and *Electrochemical Supercapacitors: Scientific Fundamentals and Technological Applications* by Conway, deal with particular aspects of electrochemical techniques and/or nonaqueous electrochemistry more rigorously than this text. Some topics are not covered particularly well, e.g., batteries using nonaqueous electrolytes. This and the fact that the text includes a number of misleading typographical errors, overly generalized statements, e.g., ionic liquids are almost harmless to human health and the environment, and the tendency of the author to cherry pick content for the topics covered may be misleading or confusing to someone unfamiliar with these topics. With this caution, however, this is a highly useful introductory text for beginners in this area, especially with regard to references to recent relevant literature.

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