

Tin Chemistry

In compiling their book *Tin Chemistry: Fundamentals, Frontiers, and Applications*, the four editors have based it on the recently published second edition of the monograph *Organotin Chemistry*, by Alwyn G. Davies, some citations from which are to be found in the new book. With the exception of a single 14-page report on inorganic zintl ions, the enlargement to form the larger work has not resulted from the inclusion of typical inorganic topics such as oxido- or chalcogenido-stannates in current molecular, nano- or mesostructured variants, stannaborates and their derivatives, or subvalent tin clusters. Instead, the book contains additions and/or deeper insights on materials science issues, comments on the importance of tin (organic) compounds in medicine and biocides, as well as tin-specific environmental aspects. There are also chapters on the use of tin compounds in organic synthesis and catalysis, topics that were only briefly touched on in the previous book.

Tin Chemistry: Fundamentals, Frontiers, and Applications includes 40 contributions from a total of 70 authors, grouped in six main chapters: 1) Introduction and Overview, 2) Fundamentals in Tin Chemistry, 3) Materials Chemistry and Structural Chemistry of Tin Compounds, 4) Medicinal/Biocidal Applications of Tin Compounds and Environmental Aspects, 5) Tin in Organic Synthesis, and 6) Tin in Catalysis. Apart from a sometimes incomprehensible assignment of several of the contributions to the “Fundamentals” chapter, and some occasional inept sequences of topics, the work creates a good overall impression and provides multifaceted, entertaining, and informative reading, not only for specialists. The book gives a broad overview of current syntheses, structures, and potential applications of tin (organic) compounds. However, the collection is not intended to serve as a guide to beginning experimental work. It contains properly researched bibliographies at the ends of the contributions (although with some typos that are typical for first editions), which lead the reader directly to sources of further information.

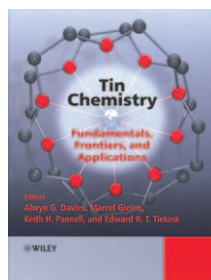
An introductory chapter comprises general statements about the element tin and synthetic routes to (only) organic compounds, which is followed by a part discussing basics of tin (organic) chemistry. This chapter begins with a very informative article on ^{119}Sn NMR spectroscopy, ranging from the principles of this analytical method to comprehensive tables summarizing ^{119}Sn NMR data. Subsequent to this, one finds a collection of contributions on different classes of organotin compounds, plus the one on zintl anions already mentioned above. The articles mostly refer to

syntheses and structures of a certain class of compounds—in some cases with a very narrow focus, such as the reports on benzannulated N-heterocyclic stannylenes and their homologues, deltahedral zintl ions, or tetraorganodistannoxanes, which are discussed with emphasis on their impressive structural diversity. Other articles focus on more general characteristics, such as unusual modes of coordination or binding of tin atoms.

The following chapters of the book, namely those on materials chemistry and on medicinal and biological properties of tin compounds, deal mainly with applications. Accordingly, they concentrate on the desired properties or a desired effect of the substances, which usually include several different classes of compounds. These sections are less detailed with regard to syntheses, but concentrate on the description of analytical methods, the procedures used to screen for potential applications, as well as descriptions of successful applications of specific compounds. In the chapter on materials chemistry, 15 relatively short and rather specialized articles inform the reader about latest developments in hot topics such as CVD of SnO_2 films, tin-based sensors, tin-based hybrid materials and polymers, the use of tin compounds as PVC stabilizers, and applications of tin compounds as flame retardants. Certainly unusual for a book with “chemistry” in the title, but highly topical in view of the increasing emphasis on interdisciplinarity, are the contributions on medical applications, biocides, and the environmental relevance of the metal in the compounds. Besides rather popular topics such as xenobiotic effects of organotin compounds (which are, however, presented from a scientific viewpoint), the chapter reviews the state of the art in the wide field of pharmaceutical and biocidal applications of tin compounds. The reports emphasize drug design throughout, while convincingly discussing the advantages and disadvantages of the use of the title compounds.

The most extensive chapter, spanning 280 pages, is that on applications of tin compounds in organic synthesis. It includes both very specific articles and broader essays: beside a description of S_{E} reactions of allylstannanes one finds, for example, articles on solid-supported tin chemistry, on the Stille cross-coupling for syntheses of natural products (30 pages), the use of tin in carbohydrate formation, and green organotin chemistry. In this chapter, the reader gains a very comprehensive overview of synthesis pathways for organotin compounds, and is invited to further reading by using the extensive bibliography (1958–2008).

Particularly owing to their Lewis-acidic properties, tin compounds are of interest for catalysis—today more than ever in the context of “green chemistry”. Therefore, the final chapter of the book takes up the latter issue once more, before it



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continues with two very specific points, tin-catalyzed isocyanate reactions and perchlorate-catalyzed reactions of allyltin compounds or organotin phenoxides.

To balance the mainly synthetic, structural, and applications-oriented focus of the book, a rather clumsy attempt is made to provide a bridge to the theoretical description and modeling of tin compounds. A short but very sound and topical article at the end of the "Fundamentals" chapter introduces quantum-chemical methods for structure optimization and for calculation of spectroscopic and thermochemical data, highlighting the importance and necessity of considering relativistic corrections. However, this contribution is not complementary to the other articles, but rather represents an unnatural-looking contrast, since it is based on and assumes a sound understanding of the MO-theoretical analysis of molecules in general and tin compounds in particular. This is in contrast to discussions in the other articles (with the exception of the one on zintl anions): how can a book appearing in 2008 allude to available 5d orbitals and any kind of hybridization of the tin atoms, both in the global introduction (!) and in many other places? Today, every student, at least in advanced courses on inorganic and theoretical chemistry, learns that d orbitals do not contribute significantly to the bonding of main-group elements, and that the concept of hybridization is rather inappropriate here. If an expert in the field had been consulted beforehand, perhaps it would have prevented that wrong description—which is, however, still very popular in organic and organometallic chemistry—from appearing in this otherwise very up-to-date book. Unfortunately, for that reason the book can only be recommended with some reservations for students, who are quoted explicitly as a target group—unless one makes the effort to point out this deficiency and to sort it out. It is explicitly recommended that the editors provide an appropriate erratum prior to a new edition.

Apart from this serious, although thematically not central, matter, there is only one more point of

criticism: The book contains numerous repetitions, which sometimes indicate insufficient coordination of the articles. Sometimes identical compounds are discussed at two places without cross-reference to each other, as in the case of the double description of distannenes. In the articles on applications-related subjects, the repetition in the introductory sections of the separate contributions tends to become increasingly tedious. An overall introduction at the beginning of each of the six main chapters would have been valuable, not only to save pages, but also to strengthen the impression of a careful editorial review of the content. One could argue that each individual contribution meets the requirements of a stand-alone survey, but an "instruction manual" in the editorial, quoting the general introductions, would have served that purpose better.

Nonetheless, the final assessment of the book, whose strong point is the multidisciplinary of subjects related to tin (organic) compounds, is positive overall. While it will probably not become a standard work or a basic textbook of (organometallic) chemistry, it may well serve as a valuable, comprehensive, and up-to-date reference work for synthetic chemists or colleagues who are interested in one of the application-based fields mentioned above. It is therefore a book that scientists who are attracted by tin chemistry, or those who look for interesting alternative approaches to subjects that go beyond synthesis and structures, certainly should own.

The incorporation of a larger percentage of inorganic or theoretically oriented chemistry would be welcome for another edition, in order to increase the spectrum and accuracy of the content and to finally justify the general book title.

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