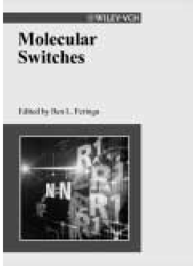
Not a Turn Off!

Molecular Switches. Edited by *Ben L. Feringa.* Wiley-VCH, Weinheim 2001. 454 pp., hardcover € 139.00.—ISBN 3-527-29965-3



Molecular switches are molecules or aggregates made of a few molecules which can reversibly change their condition by an external stimulus, for example light, electronic, magnetic, or chemical influences. The growing interest in this kind of functional materials is proven by the growing number of publications on this field: whereas a total of 30 publications on this topic were registered at the Science Citation Index in 1993, the total number exceeds 170 in 2001.

Interestingly, within this growth, the publications on nonbiological molecular switches claim a constant share of 40%. It is mainly this theme of nonbiological molecular switches which is—apart from one chapter—the topic of the book "Molecular Switches".

The editor Ben L. Feringa aims to illuminate the basic principles and various scientific approaches as well as the currently still-limited applications of molecular switches. In his preface he explicitly states that he does not claim to have written a comprehensive treatise of the topic. Instead, he wants to introduce the spectrum of fascinating perspectives and principles, which are elucidated through the synthesis of new molecules designed as molecular switches.

This section contains book reviews and a list of new books received by the editor. Book reviews are written by invitation from the editor. Suggestions for books to be reviewed and for book reviewers are welcome. Publishers should send brochures or (better) books to the Redaktion Angewandte Chemie, Postfach 101161, D-69451 Weinheim, Federal Republic of Germany. The editor reserves the right of selecting which books will be reviewed. Uninvited books not chosen for reviews will not be returned.

This concept explains the topical choice of the book's chapters, which at first glance seem to be chosen somewhat arbitrarily and in spotlight fashion. Some of the chapters deal with particular types of switching processes (e.g. the light-induced electron and energy transfer, or chiroptic molecular switches), others take compound classes as their guideline. By this arrangement, thematic repetitions cannot altogether be avoided, but instead of being annoying they serve to underline the importance of particular aspects.

The discussed structures comprise, amongst others, derivatives of porphyrins and fulgides, sterically overcharged alkenes, catenanes and rotaxanes, as well as (synthetic) polypeptides. Types of switches dealt with are based on various optical variants, redox processes, and several complex-chemical or supramolecular principles.

Furthermore, one chapter of the book deals explicitly with the possibilities of interpreting the behavior of various compounds in the sense of binary logical units. The linkage of such logic gates to complex networks, which is extremely important for information technology, still fails in the case of their chemical counterparts because of the incompatibility of the input and output signals of the hitherto presented substances.

Some of the compounds discussed are closely tied to supramolecular processes. In this way, for example, recognition processes on a molecular level serve partly as initiators for the switching operation or, in other examples, molecular receptors can be switched according to their recognition ability. Therefore, the extensive treatment of the theme of such receptors as well as the discussion of the coupling of molecular switches with supramolecular structures, for example, liquid crystals, serves to enrich the book.

Overall, "Molecular Switches" gives a review of a broad thematic variety. In doing so, the authors and the publisher produce an excellently balanced portrayal of physical and chemical contexts.

Up-to-date literary references, a good subject index, as well as a register of abbreviations sorted by chapter round off the extremely positive picture of this first comprehensive compendium on molecular switches.

On the whole, "Molecular Switches" by Ben L. Feringa can be highly recommended to the beginner in the field of molecular switches as well the chemist and material scientist working in this field.

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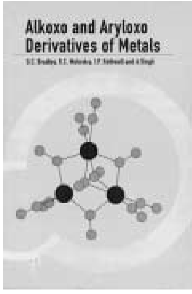
Alkoxo and Aryloxo Derivatives of Metals. Edited by *D. C. Bradley, R. C. Mehrotra, I. P Rothwell* and *A. Singh.* Academic Press, San Diego 2001. 704 pp., hardcover £ 119.95.—ISBN 0-12-124140-8



In their book *Metal Alkoxides*, published in 1978, Bradley, Mehrotra, and Gaur established this interesting class of compounds for the first time as a subject for ongoing treatment in book form. Unfortunately that first version sold out quite rapidly, and surprisingly it could no longer be found in many libraries, a fact that is also mentioned by Malcolm Chisholm in his preface to the present book. About five years ago, during a visit to London, Don Bradley confided to me that he had succeeded in recruiting one of the authors of the original work (a colleague of long standing) and two other experts in alkoxide chemistry to join him in preparing a revised and enlarged edition of the work. At the time I regarded the project as long overdue, especially since alkoxide chemistry had experienced a virtual explosion of further development in the intervening 20 years. Metal alkoxides are now important not only as starting compounds for many syntheses but as key components in a new kind of solid-state chemistry ("chimie douce", "soft inorganic chemistry"), in which they serve as versatile precursors for the preparation of new ceramic materials and thin oxide films for applications in microelectronics. The ability to control their hydrolytic properties over a wide range, and their unique intrinsic thermal properties (volatility!), resulting from the thermodynamic stability of the M–O bond, are used to advantage in sol–gel technology and in chemical vapor deposition (CVD) processes. On the other hand, the kinetic lability of the M–O bond in metal alkoxides leads to applications in many important catalytic processes.

The book *Alkoxo and Aryloxo Derivatives of Metals* has a clear arrangement of the contents in seven tightly structured chapters. Chapter 1 briefly explains the restructuring and changes in emphasis compared with the previous work. Chapter 2, "Homometallic Alkoxides" (178 pp., 1056 literature references), describes the different methods for synthesizing alkoxide compounds, such as the reaction of a metal amide with an alcohol, or alcohol exchange reactions ("alcoholysis"). This is followed by descriptions of the three most important types of alkoxide ligands, in which the hydrocarbon moiety may be entirely aliphatic, donor-functionalized, or fluorinated. The physical properties of homometallic alkoxides are discussed with special emphasis on those aspects that are relevant to applications, such as molecular complexity and volatility. Spectroscopic properties are also discussed in detail. The "homoleptic" alkoxide complexes (also including donor–adduct complexes) are tabulated according to methods of synthesis and characterization, providing a very useful aid to understanding and clarification. This chapter also discusses important types of reactions of homometallic alkoxides and their applications in catalytic processes such as the Tishchenko reaction, MPV reductions, and the Oppenauer oxidation reaction. Even some special reactions are discussed in detail, such as those in which alkoxide complexes containing a metal–metal multiple bond react with small substrate molecules (CO, ethylene, etc.).

Chapter 3 (45 pp., 237 refs.) is devoted to the synthesis and characterization of heterometallic alkoxides. The renaming of this chapter from "Double Alkoxides", as in the earlier work, to "Heterometallic Alkoxides" is appropriate, as hetero-tri- and hetero-tetrametallic systems have been unambiguously characterized in the intervening period. Element combinations such as Ca/Ba/Zr are also capable of forming interesting single component precursors for preparing mixed-metal oxide ceramics. There is an impressive description of the use of anionic "metal alkoxide ligands" for systematically building up hetero-multimetal alkoxides.

Chapter 4, "X-Ray Crystal Structures of Alkoxo Metal Compounds" (153 pp., 533 refs.), discusses the structural chemistry aspect of the topics treated in the two previous chapters, taking into account the many structural studies that have been reported. Although there is such a wide variety of structures, some important general features of alkoxide complexes can be identified. Their structural chemistry is discussed in a systematic order for the relevant Main Group and Transition Group metals. The most important structural geometries and bonding modes are described clearly and concisely, and the essential structural data (coordination numbers, M–O distances for terminal and bridging groups) are summarized in a systematic and convenient form in 27 tables. Some important molecular structures (62 altogether) are illustrated by either ball-and-stick or ellipsoid-type figures. The latter have the disadvantage that they do not show the positions of the most important atoms.

Chapter 5 (60 pp., 194 refs.) provides an insight into the fascinating structural chemistry of the metalloxo alkoxides $[MO_x(OR)_{(y-2x)}]_z$. Oxo and hydroxo ligands serve as efficient nucleation centers, leading to the formation of large complex cluster structures, which represent the transition from oligomeric metal alkoxides $[M(OR)_y]_n$ $(x=0)$ to three-dimensional macromolecular metal oxides $[MO_{y/2}]$ $(x=y/2;\ y=\text{oxidation state of M})$. Such metalloxo alkoxide clusters can therefore be regarded as true intermediates in the sol–gel process. In addition to the hydrolytic mechanism of formation, alternative synthetic routes such as ether and alkene elimination reactions are also discussed.

The now immense and growing importance of metal aryloxides has been recognized by devoting a separate chapter to this topic (Chapter 6, 224 pp., 585 refs.). Based on examples in nature, such as the complexation of iron by the tyrosine phenolate group in transferrins, or the catecholate complexation of iron in siderophores, aryloxides are used as guiding ligands for stabilizing small molecule complexes in catalytic processes. The first sections of this chapter are concerned with the classification of ligands into groups such as monoaryloxides, bisaryloxides (catechols, bisphenoxides, bisnaphthols, bis-salicyldiimines), and also macrocyclic bisphenoxides, polyaryloxides, and calixarenes. The last three classes are not treated in detail, which is understandable. The chapter provides important information about synthetic methods, bonding types (oxygen–metal π-bonding), reactive properties (cyclometalation reactions, insertion into metal–aryloxide bonds), and catalytic applications, with the main emphasis on monoaryloxide complexes. In addition there are comprehensive tables of data on molecular structures determined by X-ray crystallography, listing M–O bond lengths and M–O–Ar bond angles, arranged under ligand classes and element groups (altogether 52 tables, with literature references repeated here as footnotes). The reader's attention is drawn to some striking contrasts—for example, whereas only one structurally characterized aryloxide complex of beryllium is listed, there are at least 165 for titanium.

The last chapter, "Industrial Applications" (16 pp., 131 refs.), contains a fairly brief and concise survey of the main areas of application of metal alkoxides, which are in the production of metal oxide films, ceramics, and glasses, as well as in catalysis. Here the authors have rightly recognized that a detailed treatment of these aspects would not be possible in a book of this kind, and therefore they give instead a well-chosen collection of references to the most important review articles. The work is completed by a subject index consisting of 18 two-column pages.

This book provides a comprehensive overview of a very important class of chemical compounds, and it has appeared at the right time. *Alkoxo and Aryloxo Derivatives of Metals* will gain a place as a valuable work of reference, and indeed as the standard work on alkoxide chemistry. It is to be hoped that it remains available on the market longer than its predecessor.

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The Transuranium People: The Inside Story. By *Darleane C. Hoffman, Albert Ghiorso* and *Glenn T. Seaborg*. Imperial College Press, London 2000. xciii + 467 pp., hardcover $ 112.00.—ISBN 1-86094-087-0

The Lawrence Berkeley Laboratory (formerly the Lawrence Radiation Laboratory), the organization with which the authors of this fascinating book have long been affiliated, is the site of the discovery of more transuranium elements than any other laboratory in the world. The book's title is well chosen, and the authors are the ideal persons to have written it. The volume is a felicitous and balanced blend of personal reminiscences, history of science and technology, and nuclear science. The authors are true nuclear pioneers, who from an early stage were conscious of their place in history and consequently recorded events in incredible detail. It should appeal not only to persons interested in these matters but also to anyone concerned with the development of science policy and the role of governmental support for research during both wartime and peacetime.

The volume is carefully organized with its 15 chapters divided into numbered sections, subsections, and subsubsections, all meticulously cross-referenced. Although scrupulously documented, with altogether 245 references that appear at the ends of the chapters, it is eminently readable and frequently laced with humor. A sense of the authors' excitement evoked by the historical events in which they participated is conveyed by their frequent use of exclamation marks. The book reads like a veritable "Who's Who" of nuclear science; hundreds of pioneers come to life on its pages.

The text proper is preceded by 93 pages which include a three-page tribute to 1951 Nobel chemistry laureate Glenn T. Seaborg (1912–1999), who died after suffering a stroke at the August 1998 American Chemical Society national meeting in Boston, followed by first-person "Intimate Glimpses of the Authors' Early Lives" (72 pp.), and a three-page glossary of the numerous acronyms, decay modes, units, and prefixes referred to in the book.

In the "Intimate Glimpses" the authors present interesting, fascinating, and often little known details about their lives, both personal and professional. For example, we learn that Darleane Hoffman (née Christian, born in 1926) decided at Iowa State University, Ames, to switch her major from applied art to chemistry, after taking a required course in home economics chemistry, at a time when chemistry was an unusual profession for a woman and usually limited to "spinsters". She recollects that in 1951, when she married physics graduate student Marvin Hoffman (who then remained at Ames to pursue his doctoral studies, while she, who had just received her PhD, left to work at the Oak Ridge Nuclear Propulsion Project), Marvin's doctoral supervisor told him the marriage was a "horrible mistake… [that] would never last under such unconventional circumstances". Their daughter, Maureane, is now a professor at the Duke University Medical School, and their son, Daryl, is a plastic surgeon.

When Darleane Hoffman went to the Radiochemistry Group of the Test Division of Los Alamos Scientific Laboratory (LASL) in 1952, she was told, "We don't hire women in that Division". Despite these and other examples of sexism, she went on to become a "genuine transuranium person", becoming the first woman Division Leader of the LASL Chemistry/Nuclear Chemistry Division, and eventually Professor of Nuclear Chemistry at the University of California, Berkeley (since 1984). She received numerous honors; her American Chemical Society national awards include the Award for Nuclear Chemistry (first woman, 1983), the Garvan Medal (1990), and the Priestley Medal (the society's highest award, 2000).

Albert Ghiorso, the fifth of seven children of a poor family, whose father sold "bootleg" liquor during Prohibition, was born in 1915 and received his bachelor's degree as an electrical engineer from the University of California, Berkeley in 1937 during the Great Depression. Because no jobs were available, he earned money by constructing and selling amateur radio equipment. By 1941 he was producing Geiger–Müller counters for the Manhattan District Atomic Energy Project and often visited the UC Berkeley Radiation Laboratory, where he met Wilma Belt, the secretary of Donald Cooksey, Ernest Lawrence's deputy. In 1942 he married Wilma and joined the Chicago Metallurgical Laboratory, where he took care of the instrumentation needs of Glenn T. Seaborg's group, whose task was "to determine the complete chemistry of an element that no one had yet seen" (plutonium). He developed new and improved methods for determining different types of nuclear radiation and was involved in the discovery of several transuranium elements. In 1946 he returned with Seaborg to the Berkeley Radiation Laboratory, where he continues to work. In 1973 he received the ACS Award for Nuclear Chemistry. His son, William Belt Ghiorso, who joined the laboratory in 1978, collaborated with him in an experiment to produce element 110.

Because Seaborg kept a daily journal for more than six decades since 1 January, 1927, when he was fourteen, we were not surprised by the depth of detail in his reminiscences. Although we have written several articles about him, we encountered biographical facts of which we were unaware and photographs that we had not seen (the picture of his third class shows that as early as the age of nine, because of his height, he was already relegated to the back row of group pictures). Fortunately, he was able

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