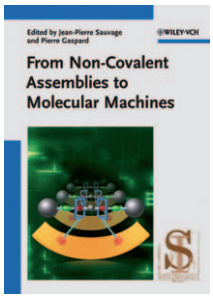

From Non-Covalent Assemblies to Molecular Machines
Edited by Jean-Pierre Sauvage and Pierre Gaspard. Wiley-VCH, Weinheim 2010. 478 pp., hardcover € 149.00.—ISBN 978-3527322770

From Non-Covalent Assemblies to Molecular Machines

As a crystal structure often encapsulates only a snapshot of a complex structure, which may or may not be at equilibrium at the time of the snapshot, so this book "captures" the state of the complex field of supramolecular chemistry through the lens of a Solvay Conference held at the end of 2007. These conferences aim to bring together the best scientists working in a topical subfield of either physics or chemistry.

Each of the book's chapters is adapted from the conference talk given by one of the field's leading lights. Two points render it far more worthy of interest than a typical collection of conference proceedings.

First, the format of the conference included several overview talks given by a major figure on a theme wherein his (never her, alas) work figured prominently, but each of these talks also included the contributions of others. These thematic talks included Makoto Fujita on the design and synthesis of non-covalent assemblies, Fraser Stoddart on molecular topology, Vincenzo Balzani on rotaxane- and catenane-based machines, Ben Feringa on rotors and motors, Devins Gust on artificial photosynthesis, and Jean-Pierre Launay on molecular devices and transport. These thematic talks are particularly well-translated into chapters, which is more than can be said for other proceedings-derived books. In addition to providing a window into the "state of play" at the time of the conference, many important challenges for future academics are identified by these speakers.

The second, greater point of interest is the transcriptions of the freewheeling discussions that followed the talks. Although a dissonant note is occasionally sounded by a questioner's reference to a speaker's talk that was not transcribed into a chapter, overall these discussions add much to the pleasure of reading the book. Such conference discussions are one of the most important forges of the scientific process, and those in attendance wield their hammers with great expertise. One can sense the intellectual sparks flying as ideas are beaten into shape by different minds, shedding the slag of muddled thought with each blow, leading to solid, tempered theories that can be used and built upon by others.

Several questions recurred as leitmotifs in these discussions, such as:

- Should the functioning of natural biomachinery be imitated in the creation of synthetic molecular machines, or should new mechanisms be designed from first principles?
- To what degree should one be driven by utility and application, as opposed to fundamental curiosity and even beauty in the synthetic pursuit of complex molecular assemblies and mechanisms?
- Is it more useful to have enough knowledge to be able to design, and then synthesize, an optimal receptor for a given target molecule, or should intelligence be applied to designing a system that is capable of expressing an optimal receptor without a priori knowledge of what that receptor should look like?

None of these questions have "right" answers, which does not detract from the usefulness of asking them.

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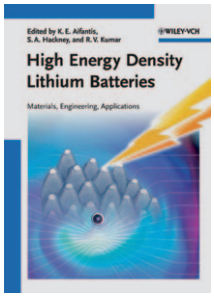

High Energy Density Lithium Batteries
Materials, Engineering, Applications. Edited by Katerina E. Aifantis, Stephen A. Hackney and R. Vasant Kumar. Wiley-VCH, Weinheim 2010. 266 pp., hardcover € 109.00.—ISBN 978-3527324071

High Energy Density Lithium Batteries

Lithium batteries have achieved a leading role in modern technology since, due to their high energy content, they are the power sources of choice for the portable electronic devices market (including popular products such as cell-phones, laptop computers, mp3 players, etc.), and are also entering aggressively into the power tool equipment market. Moreover, lithium batteries, by virtue of their high energy efficiency, are leading contenders as storage systems for alternative energy sources, and they appear to be the most promising devices as efficient power sources for hybrid vehicles, or even fully electric vehicles, thus contributing to the progress of sustainability in our society. Due to these unique advantages and the prospect of new applications, lithium batteries have attracted continuously growing interest worldwide, which has also been stimulated by high levels of funding for research and development. Academic and industrial laboratories are now achieving important advances and publishing their results. It is therefore not surprising that many reviews and books describing the chemistry of lithium batteries and technological progress in the area are appearing in the relevant literature and in libraries. This book edited by Aifantis, Hackney, and Kumar and published by Wiley-VCH is the latest addition to such works. The book is pleasantly written and very well edited. The only possible fault is in the lack of information on some of the very latest developments in the field. For example, there are no

chapters devoted specifically to the lithium–sulfur and lithium–air systems that many regard as the likely basis of the batteries of the future.

The book opens with a chapter introducing the basic thermodynamic and kinetic aspects of electrochemical cells, and explaining their classification according to their primary or secondary properties. The chapter also includes a section on the recycling of batteries, although it deals mainly with lead–acid batteries and contains only a brief mention of lithium systems. This is unfortunate, since recycling is one of the present concerns, and a critical comprehensive discussion of the challenges and prospects of lithium battery recycling would have been welcome, especially considering the relevant European Community mandate that is expected to be in force in the very near future.

The second chapter is devoted to primary batteries, including a historical review and description of alkaline and zinc batteries. With regard to lithium, the chapter describes batteries using thionyl chloride and sulfur dioxide cathodes. Although of no particular novelty, the chapter can be useful for newcomers to the field, and/or for students attending electrochemistry courses.

Chapter 3 deals with secondary batteries. Here also, the greatest attention is devoted to conventional systems such as lead–acid, nickel–cadmium, and nickel–metal–hydride. The part concerned with lithium is mainly confined to the descriptions of the cell components and of the mechanistic principles of lithium ion batteries. A section is devoted to lithium–sulfur batteries; regrettably, however, there is no mention of the latest developments of this high-energy system.

Chapter 4 provides a comprehensive discussion of the present and expected applications of lithium batteries, as well as of the practical measures to be considered for addressing the question of safety hazards. The chapter is valuable, especially for engineers and technicians involved in the lithium battery business.

In Chapter 5, the reader finds a discussion of the fundamental and engineering aspects of lithium-ion cathode materials. The chapter is valuable for the information that it contains about the thermodynamics, discharge characteristics, and energy density, and on chemical modifications of these materials.

Chapter 6 enters the new development areas, with particular attention to the anode side. Appropriately and accurately, the author focuses on advanced materials such as lithium–metal alloys, with a discussion about their practical relevance, the problems that prevent their full exploitation, and the approaches to be followed to overcome them. In this respect, attention is also devoted to nanostructures such as nanofibers, nanotubes, nanopillars, and similar structures, which are presently under development as potential high-capacity electrode materials, such as lithium–tin and lithium–silicon alloys. The analysis is completed by a discussion of nanocomposites, which are the structures that are nearest to achieving practical application.

Chapter 7, entitled "Next-Generation Electrolytes for Li Batteries", is slightly disappointing. Although proper attention is devoted to polymer electrolytes (which are attracting renewed interest due to their expected safe operation in conjunction with a metal–lithium electrode), no mention is made of media based on ionic liquids. That omission is unfortunate, because these room-temperature molten salts, due to their high thermal stability and non-flammability, are considered very promising electrolyte materials for improving the safety of lithium batteries. Interest in these materials is growing rapidly, and the current literature contains many reports about work on their properties and their potential as advanced lithium battery electrolytes.

The book ends with Chapter 8, which describes the mechanical changes that can affect different electrode materials during the evolution of their electrochemical processes, and discusses the implications for the cycle life of the batteries that employ them. These are very interesting and original topics that are rarely found in other books on the field.

Overall, this is a good book that deserves to find its place on the shelves of all who are involved in the science and technology of lithium batteries.

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DOI: 10.1002/anie.201101978