

Encyclopedia of Nuclear Magnetic Resonance. Volume 9. Advances in NMR. Edited by David M. Grant (University of Utah) and Robin K. Harris (University of Durham). John Wiley and Sons: Chichester. 2002. xviii + 862 pp. \$610.00. ISBN 0-471-49082-2.

If there is a hallmark of nuclear magnetic resonance spectroscopy, it is the constant development of technology, methodology, and applications in this field. When the first eight volumes of the *Encyclopedia of Nuclear Magnetic Resonance* were issued in 1995, NMR spectroscopy had reached its 50th anniversary, a point at which the technology and methodology of most other fields would be viewed as mature. The variety of articles in those volumes attested to the diversity of applications in chemistry, biology, materials science, and allied fields and to the half-century of technological developments in laboratories across the world that made those applications possible.

Six years later, we are presented with an addendum that includes developments that were perhaps nascent or incompletely understood when the first volumes were released. The book is divided into two parts. In the first are articles that deal with technology and spectroscopic properties (the stuff that makes spectroscopists' hearts throb), for example, double-quantum NMR, symmetry-based pulse sequences, diffusion-ordered spectroscopy, spinning-sideband analysis, multiple-quantum magic-angle-spinning NMR, and many, many more spectroscopic developments. One important and interesting area discussed is the calculation of chemical shifts with modern computer-based techniques, including relativistic corrections that are important for some spins.

In the second part, the articles focus on applications of NMR spectroscopy to chemical, biological, and physical systems and how the spectroscopy can be arranged to obtain specific information for various kinds of materials. Whether the area is carbanion chemistry, liquid crystal dynamics and structure, combinatorial chemistry, protein structure, interactions between components of biological systems, conformations of glassy polymers, electronic effects in semiconductors, rheological measurements, or any of a number of other fascinating projects, there is some article in this volume to address it.

This volume is a valuable addition to the *Encyclopedia of Nuclear Magnetic Resonance*, which is a very useful tool in our own laboratory. With contributors who are eminent practitioners of the science, the articles are authoritative, and their topics span modern developments in NMR spectroscopy. One asks, upon seeing a collection like this, how much longer the kinds of innovation in NMR spectroscopy demonstrated here will continue. In 1995, I would have thought that we had seen most original developments in the previous 50 years. This

volume shows that development continues unabated as NMR spectroscopy moves toward its centenary.

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Advances in Lithium-Ion Batteries. Edited by Walter A. van Schalkwijk (University of Washington, Seattle) and Bruno Scrosati (University of Rome, "La Sapienza"). Kluwer Academic/Plenum Publishers: New York. 2002. x + 514 pp. \$120.00. ISBN 0-306-47356-9.

The editors state in their introduction that this book is intended for lithium-ion scientists and engineers, but they hope it may be of interest to scientists from other fields. Their main aim was to provide a snapshot of the state-of-the-art in lithium-ion research, and in this they have largely succeeded. The book is comprised of a collection of very current reviews of the lithium-ion battery literature by acknowledged experts. The articles draw heavily on the authors' own research but are sufficiently general to provide the lithium-ion researcher with enough guidance to the current literature and thinking in the field. The book should be instructive to the chemical community, provided the average chemist obtains some guidance from an electrochemist or battery engineer. Many of the measurements and techniques referred to (e.g., impedance, capacities, etc.) may be somewhat unfamiliar and confusing in the context in which they are used. Chemists who persevere will find some rich opportunities for the application of analytical, inorganic, and organic chemistry to unravel some of the puzzling mysteries of these batteries.

From the viewpoint of the researcher in lithium-ion batteries, the book covers most of the topics that are of current interest. Two areas are treated by inference in the various chapters but are not specifically granted chapters of their own. One of these is safety and abuse tolerance, and the other is cost. These are curious omissions because there are a number of groups active in the investigation of abuse tolerance of these batteries, and, obviously, the cost factor is a driver for commercial development. Some more explicit treatment of these topics might have been appropriate.

The book begins with an extended chapter on the crucial role of the surface films on electrodes and provides an excellent introduction to the state of thinking in this field. This work is a tour de force in the application of surface analytical techniques and clearly demonstrates some of the shortcomings in the development of mechanisms for understanding the role of surface films in lithium-ion batteries. Several other chapters also provide ample evidence of opportunities for mechanistic determination, and the chemist may be left with a rather alarming impression of a very unstable electrolyte system. However, the

chapter on surface films will sound familiar to any chemist who has suffered the vagaries of a recalcitrant Grignard reaction. Because the operation of these surface films is of such importance to lithium-ion batteries, one is amazed that their formation appears to be left to serendipity. Clearly, there are great opportunities here for imaginative chemists and engineers.

One is struck by the contrast between the chapter on modeling and many of the descriptive chapters. The modeling work only addresses continuum models but is extremely rigorous, requiring accurate quantitative measurements, whereas much of the content in the phenomenological chapters is very qualitative in nature. The coverage of modeling fails to include either molecular dynamics for ion transport or *ab initio* calculations for chemical reactivity, although there is much activity on these topics in the chemical literature. This is disappointing for the chemist but probably is a reflection of the gap between practice and theory, particularly in the area of electrolytes. The chapters on electrode materials are rather short in comparison to those on electrolytes and interfacial phenomena, perhaps reflecting the more mature base of knowledge in these areas.

There are chapters on scale-up, manufacturing techniques, and charging and monitoring that provide useful perspectives for some of the choices of materials that go into making lithium-ion batteries. The chapter on aging summarizes the effects of the chemistry on battery performance, although this is one area where the newcomer to batteries might need considerable interpretation and guidance. This chapter illustrates the use of empirical modeling to predict lifetime and also demonstrates where the development of a more quantitative database on the chemical reactivity would be invaluable. This would be a fertile area for physical organic chemists. Also of interest to chemists is the description of ionic liquids as electrolytes, which should open new opportunities for new electrochemical couples, as exemplified by Scrosati's chapter on low-voltage systems. The descriptions of the polymer-gel systems should also provide indications to polymer scientists about where their skills are needed to facilitate the development of the technology.

With a couple of notable exceptions, the book does serve as a guide for future development for most aspects of the chemistry lithium-ion system and is definitely a valuable snapshot of the state-of-the-"by-no-means-finished"-art of lithium-ion batteries. However, the numerous grammatical errors are a nuisance and are distracting. More careful editing would have been helpful.

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Van Nostrand's Scientific Encyclopedia. Ninth Edition. Volumes 1–2. Edited by Glenn D. Considine (Editor-in-Chief) and Peter H. Kulik (Associate Editor). John Wiley & Sons, Inc.: New York. 2002. 3936 pp. \$350.00. ISBN 0-471-33230-5.

The new edition of this encyclopedia has been extensively updated since the last volume, which was published in 1994, and it is an amazing accomplishment. Not only does it cover an enormous range of topics (animal life, biosciences, chemistry, earth and atmospheric sciences, energy sources and power technology, mathematics and information sciences, ma-

terials and engineering sciences, medicine, anatomy, and physiology, physics, plant sciences, and space and planetary sciences), it does so thoroughly and descriptively. Where else can you find a description, complete with Web information, of the American Association for the Advancement of Science alongside an entry for the aardvark, which is almost lyrical in its coverage, as can be seen from the following excerpt: "The aardvark is solitary. In daytime it sleeps curled up like a dog in one of its burrows, often beneath a termite hill. The animal moves almost entirely at night, when it seeks termite hills and destroys them to reach the interior chambers and tunnels alive with insects, which it rapidly licks up in lumps. Although usually silent, the animal can grunt like a hippopotamus." An expanded subject index completes the volumes.

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Modern Advances in Chromatography. Advances in Biochemical Engineering/Biotechnology, Volume 76. Edited by Ruth Freitag (Ecole Polytechnique Fédérale Lausanne). Springer-Verlag: Berlin, Heidelberg, New York. xii + 272 pp. \$169.00. ISBN 3-540-43042-3.

This book contains reviews that focus on seven different methodologies for chromatographic separation that have recently emerged as major strategies for the separation of biomolecules. The objective of the book is not to introduce basic chromatographic/separation principles to someone new to the field but rather to introduce new approaches, strategies, and their underlying principles to experienced chromatographers for solving difficult and challenging problems in biotechnology.

The book is divided into seven independent but related chapters authored by researchers who have made key and significant contributions to the topics. The underlying theme of the first five chapters—"Capillary Electrochromatography: A Rapidly Emerging Separation Method", "Short Monolithic Columns as Stationary Phases for Biochromatography", "Porous Polymer Monoliths: An Alternate to Classical Beads", "Molecularly Imprinted Materials—Receptors More Durable than Nature Can Provide", and "Chromatographic Reactors Based on Biological Activity"—focuses on the heart of the chromatographic system, analyte-stationary phase interactions, their nature, and how to take advantage of these in solving biochemical problems. Although the emphasis in general is on small-scale separations, preparative level separations are also often discussed. The last two chapters, which are perhaps of greater interest on the preparative level, are "Simulated Moving Bed Chromatography (SMB) for Application in Bioseparations" and "Continuous Annular Chromatography". Their coverage tends to focus on the instrumental basis and application in the downstream processing of biotechnological materials.

In general, the authors follow a similar format in presenting their topics. First, the basic principles and theoretical background underlying the methodology/strategy are presented in sufficient detail. Key characteristics are then discussed, and finally separation conditions, unique applications, and areas of applications are presented. Each author provides a concise but comprehensive review of the subject matter. Consequently, the reader in my view will have a good fundamental understanding

of the topic, be aware of practical information and background, be introduced to synthetic issues where necessary, and be able to envision the scope and unique application of the methodology/strategy in solving specific biotechnology problems. The chapters are not surveys of applications but rather include selected literature applications to illustrate scope and uniqueness when applied in the biotechnology area. One aspect that is somewhat overlooked in those topics suited to small-scale chromatography is a discussion of quantitative and reproducible chromatography that would be of interest to many. For example, in the chapter on capillary electrochromatography, little is provided on the issue of whether this methodology is already or will be comparable to HPLC in terms of quantitative reliability and reproducibility that would be required if it is to be used effectively for more routine biochemical separations or for quality control. A similar discussion would have been useful in the molecular imprint chapter. Finally, all chapters

contain a section on "Future Outlook". These appear to be very carefully thought out and focus on some novel and interesting views. The writing and the formatting of the chapters, as well as that of the tables and figures, are clear and easily read and followed. References are current and appear to cover the major contributions.

In summary, the book presents an important overview of seven emerging chromatographic/separation methodologies and strategies that will have a significant impact on solving many problems faced in the field of biotechnology. The presentation is of high quality, encompassing, and is well suited for separation specialists in biotechnology and also in other areas where separations play a key role.

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