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BOOK REVIEWS

Comprehensive Asymmetric Catalysis: Supplement 2. Edited by Eric N. Jacobsen (Harvard University), Andreas Pfaltz (University of Basel), and Hisashi Yamamoto (University of Chicago). Springer-Verlag: Berlin, Heidelberg, New York. 2004. xvi + 136 pp. $139.00. ISBN 3-540-20983-2.

This book is the second supplement to the three-volume reference *Comprehensive Asymmetric Catalysis.* Seven chapters have been supplemented, and one new chapter "Aminohydroxylation of Carbon−Carbon Double Bonds" has been added. The book also includes a listing of the contents of Supplement I and of the original three volumes, as well as a subject index.

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Relativistic Electronic Structure Theory, Part 2: Applications. Edited by Peter Schwerdtfeger (The University of Auckland). Elsevier: Amsterdam. 2004. xvi + 788 pp. $305.00. ISBN 0-444-51299-3.

This book, which was developed from a conference honoring Pekka Pyykkö, is the second of two volumes covering a broad range of relativistic electronic theory. Its emphasis is on applications as opposed to fundamentals, which was the focus of Part 1. Inevitably there is a blurring of this distinction so that there are some applications in chapters in the first volume and some theoretical developments in chapters in this volume, particularly regarding putting methods into usable computational form.

The most common current calculations in relativistic electronic theory involve relativistic density functional theory (RDFT), relativistic effective core potentials (RECPs), or both. Among the many aspects discussed are (1) the ranges of use and accuracy of four-component, two-component, and one-component methods in RDFT and RECP theories and (2) whether nonrelativistic exchange-correlation functionals are good enough for use in RDFT. Describing and evaluating such issues in implementing these methods takes up a number of the chapters, but the range of topics in the book is much broader than this. For example, coverage of quantum electrodynamics, weak interaction (parity-violating), hyperfine structure, nuclear magnetic resonance, and solid-state applications are also included.

Methods with applications and limitations that are sufficiently broad and established so that they can be used constructively by nonexperts are not yet available. Consequently, one might ask whether further development of methods and more capable computers will allow relativistic calculations using standard software analogous to that now available for nonrelativistic calculations on organic molecules. There has been enough progress in this direction to suggest that it might be possible, but there is still a long way to go.

Among the interesting results obtained using relativistic calculations are those on very heavy atoms, namely, the ground states of Rf (Z=104) and eka-Au and the electron affinity of eka-Rn. In general terms, there is the result that a number of the trends for the properties of atoms reverse themselves at the sixth or seventh row of the periodic table. It would be nice if isotopes with sufficiently long lives became available to investigate these and other questions experimentally.

Together, these two volumes give both deep and broad coverage of the field of relativistic electronic structure theory. Although the fonts and formats in this volume vary noticeably, they are not a distraction. The number of typos seems a little higher than in Part 1, but I did not notice any in crucial places. All in all, the topics of each chapter are covered in depth, with the average length of chapters being 65 pages. This reviewer was glad to have the opportunity to review this volume (and the previous one) and make it available to his graduate students. The price of $305 will no doubt limit its purchase for individual use.

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Polyelectrolytes with Defined Molecular Architecture I. Advances in Polymer Science, Volume 165. Edited by Manfred Schmidt (Johannes Gutenberg-Universität Mainz). Springer-Verlag: Berlin, Heidelberg, New York. 2004. x + 267 pp. $249.00. ISBN 3-540-00528-5.

As stated in its preface, this monograph summarizes achievements of a six-year project launched by the German Science Foundation to attack and solve long-standing problems in polyelectrolytes, while exploring new ideas and creating new challenges for the field. Polyelectrolytes are polymers decorated with units that ionize in high dielectric constant solvents such as water, a feature endowing such polymers with properties heavily influenced by long-range electrostatic interactions. Although the traditional motivation for studying polyelectrolytes has been their crucial role in living systems, a new motivation—the tailoring of synthetic polyelectrolytes to control self-assembly—has gained momentum in recent years. The German project brought together an average of 25 research groups from across Germany and one from France to address topics as diverse as the synthesis of new chain architectures and the measurement of engineering properties for assembled structures.

This is neither an introductory text nor a broad-based review of recent polyelectrolyte research. Most chapters summarize the publications of a project team in a defined polyelectrolyte subfield, although not all subfields are represented. Nonetheless, information is organized and presented with sufficient care to make the volume useful to anyone interested in polyelectrolytes or the assembly of structure from dissolved synthetic polymers. The German project had significant worldwide impact, and one

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thus gains from this monograph an excellent perspective of the trends emerging in current polyelectrolyte research. The chapter on polyelectrolyte brushes is particularly noteworthy, providing an outstanding introduction to both theory and experiment. Other chapters are more specialized, addressing a single class of polyelectrolytes or a particular polyelectrolyte application.

No similar polyelectrolyte compilation has recently appeared; even focused reviews of the literature comparable to this monograph's chapters are scarce. A second volume in the Advances in Polymer Science Series (Volume 166), "Polyelectrolytes with Defined Molecular Architecture II", presents further results of the German project with a greater emphasis on fundamental physics. Together, the two volumes offer an insightful snapshot of topics at the forefront of polyelectrolyte research.

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Polyelectrolytes with Defined Molecular Architecture II. Advances in Polymer Science, Volume 166. Edited by Manfred Schmidt (Johannes Gutenberg-Universität Mainz). Springer-Verlag: Berlin, Heidelberg, New York. 2004. xii + 226 pp. $249.00. ISBN 3-540-00556-0.

In 1996, the German Science Foundation launched a nationwide research center on "polyelectrolytes with defined molecular architecture" that gathered together one French and 25 German research groups. The scientific outcome that resulted from six years of research has been documented in two volumes of the series *Advances in Polymer Science*, of which this book represents the second part. The book is divided into five chapters addressing topics of current interest within the polymer physics and chemistry community: stiff polyelectrolyte chains, conformation and phase diagrams of flexible polyelectrolytes, polyelectrolyte theory, polyelectrolyte complexes, and polyelectrolyte block copolymer micelles.

The emphasis of each chapter is placed on the work carried out by each group, but the authors have attempted to place their research in the context of current work worldwide. The chapter on polyelectrolyte theory stands out as a valuable reference, as it presents a review of the current understanding of polyelectrolyte solutions, describing stiff and flexible polyelectrolytes in good and poor solvents as well as their adsorption properties. The chapter on polyelectrolyte complexes offers much to those seeking an overview of the solution properties of polyelectrolyte/polyelectrolyte complexes and polyelectrolyte/surfactant complexes, but readers should be aware that sections dealing with polyelectrolyte multilayers are rather succinct.

The volume suffers from some of the common drawbacks of books whose chapters are written by different groups of authors. The writing is uneven in quality, and there has been little effort to standardize symbols and abbreviations listed at the beginning of each chapter. Each chapter is well-referenced, although unfortunately most of the references only extend to 2001, except for a few forays into 2002. There is a five-page subject index, but no author index.

Overall, this volume is a welcome addition to the series *Advances in Polymer Sciences*, which provides books focused on important well-defined topics to the polymer community.

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