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Book Reviews

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Book Reviews

“Conductive Electroactive Polymers: Intelligent Materials Systems” by G. G. Wallace, G. M. Spinks and P. R. Teasdale, Technomic Publishing Company, Inc., Lancaster, PA, 1997; ISBN 1-56676-43-8; xii + 161 pages; \$149.95, SFr, 225

In this book, the authors treat conductive electroactive polymers (CEP) as “intelligent materials”. They assert that such materials are dynamic and will have in-built sensing processing and actuating functions. The book is aimed at researchers active in the field and it is successful on that count. The authors seek to provide a “kind of handbook” and to guide future needs and research methods in this area. It consists of five chapters: Introduction; Assembly of Polypyrroles; Properties of Polypyrroles; Polyanilines and Polythiophenes; Integrated Structures. The book also has a subject index, and references are found at the end of each chapter. As indicated in the chapter titles, the book focuses entirely on three classes of CEP: polypyrroles, -anilines, and -thiophenes. In effect, the authors adopt the perspective that the existing classes of CEP are appropriate for applications, a viewpoint difficult to argue with since several of these materials have been introduced to the marketplace. Topics emphasized include polymerization (both electrochemical and chemical) chemistry, electrochemistry, processing, electrical and mechanical properties, and applications. The latter are largely discussed in the introduction chapter, and focus on batteries, electrochromic and electromechanical devices, electrochemically controlled chromatography, and a range of topics involving bioactive surfaces, especially involving polypyrroles.

The strengths of the book are in the amount of information associated with the description of the polymerization chemistry and processing detail, especially as to how different experimental conditions affect electrical and/or mechanical properties. For electrochemical polymerization, information on choice of electrode, formation of oxide on electrode, choice of solvent, choice of electrolyte, and selection of experimental configurations abounds.

It will be most useful for those beginning research in this class of materials. The final chapter on Integrated Structures deals well with the issue of obtaining CEP in composites where the other component is a "commodity" plastic.

The shortcomings of the book are of two types. First, it is not possible to be comprehensive in a book of this length dealing with a subject that has become as vast as CEP. An example of this would be the lack of treatment of the properties of the insulating forms of these polymers, such as thermochromism in polyalkylthiophenes. Second, the book tends to emphasize practical issues at the expense of the fundamentals. Issues, such as the limiting of the conductivity by structural disorder are not stressed. Topics such as polarons and bipolarons (not found in the index) are discussed, but not shown on an energy level diagram where it might be possible to assess their consequences for electrical and spectral properties. The book lacks discussion of electronic structure via use of energy level diagrams. The use of redox chemistry to render these materials electrically conductive ("doping") is extensively discussed, but the fundamental issues associated with this process, such as the energetics of charge-transfer, are omitted. There is much conductivity data in the book, but it is mostly room temperature data, as exemplified by Tables 3.1 and 3.2 dealing with effects of different counterions on the tensile strength and conductivity of polypyrrole films. While the numbers given are clearly different experimentally, the data would be more meaningful if one knew the activation energy for conductivity for the different systems.

The book is not completely free of errors and misprints. Some of the more obvious ones include: a) Scheme 2.3, p. 36 which has "H" as the heteroatom, an incomplete dimer structure in step 3, and the lack of the structure associated with step 5; b) the structure at the bottom of p. 74 which has dicoordinate N and pentacoordinate C; c) Table 4.1 on p. 111 which has a spelling mistake ("naphthlaniline") and three incorrect structural formulas.

To summarize, this book will prove to be a valuable source of information to scientists and engineers active in, or beginning, research and development activities in the area of CEP. As a teaching aid, it would require extensive supplementation.

Daniel J. Sandman
Center for Advanced Materials
Department of Chemistry
University of Massachusetts Lowell
Lowell, Massachusetts 01854-2881

“X-Ray Analysis and the Structure of Organic Molecules” by Jack D. Dunitz, Verlag Helvetica Chimica Acta, Basel, VCH Verlagsgesellschaft, Weinheim, New York, 1995; ISBN-3-906390; 514 pages; DM 108.00; sFr 108.00.

This book is a corrected reprint of Dunitz' excellent book first published in 1979. For a review of the original book, see C. E. Nordman, *J. Am. Chem. Soc.*, **102**, 5434 (1980).

Daniel J. Sandman
Department of Chemistry
University of Massachusetts Lowell
Lowell, Massachusetts 01854-2881

“Solid State Electrochemistry”, Peter G. Bruce (Ed.), Cambridge University Press, Cambridge, UK, 1997, 344 pp., paperback edition, ISBN 0-521-59949-0; \$ 39.95.

This is the paperback edition of a book edited by Peter Bruce published in 1995 (reviewed in *J. Electroanal. Chem.* **421** (1997) 228). As the editor says in the introduction, the subjects of solid and liquid electrochemistry have been more or less separated during 150 years and not until 1990s these two subjects started to grow together. This growing together of the fields was partly initiated by the discovery of conducting polymers and their introduction to the field of electrochemistry.

The stated objectives of this book are that it should bring the liquid and the solid phase electrochemistry together and that it should appeal to a broad readership beyond that of electrochemists alone. This book clearly succeeds in meeting this objective.

The scope of this volume is extensive, covering crystalline, glass and polymer electrolytes as well as intercalation electrodes. Polymer electrodes (conducting polymers) and some of their applications are presented in a separate chapter. The conducting polymers are described from the solid electrochemical point of view and are compared to the insertion electrodes. Solid electrolyte interfaces and the applications of solid electrolytes are also described in separate chapters. Proton conduction is largely omitted because of a recent book on this topic in the same series. The chapters are written by authors who are respected scientists within their own field of expertise. Most of the chapters have extensive references for more detailed reading on the topics covered.

The editor and indeed the authors have done an excellent job in putting together a book that is easy to read and informative. It is a book which can be highly recommended and which deserves to become a widely used reference work for those with an interest in electrochemistry, material research and solid state physics.

Carita Kvarnström
Laboratory of Analytical Chemistry
Åbo Akademi University
Biskopsgatan 8
SF-20500 Turku-Åbo Finland