Metal-Containing Polymeric Materials

C.U. Pittman, Jr., C.E. Carraher, Jr., M. Zeldin, J.E. Sheats, and B.M. Culbertson, eds.
(Plenum Press, New York, 1996)
528 pages, $125.00
ISBN 0-306-45295-2

Anyone who is first learning about polymers is presented with the typical examples which include polyethylene, polystyrene, and nylon. While the diversity exhibited by these polymers is impressive, the list is constrained by the presence of only carbon, hydrogen, nitrogen, and oxygen in these common polymers. Additional atoms to this list would greatly increase the variety of possible polymers. Silicon, sulfur, and the halogens are relatively common constituents of polymeric materials, but what about the rest of the elements? One often wonders, in fact, what possibilities would exist if atoms from the entire periodic table were included as potential macromolecular building blocks. A partial answer to this question is found in *Metal-Containing Polymeric Materials*. This book provides examples of polymers containing iron, cobalt, vanadium, nickel, chromium, and many of the other transition metals. The focus is primarily on polymers which contain metals atoms as an integral part of the polymer backbone, as opposed to complexes formed by incorporation of metal ions or metal particles in a polymeric host.

The book is the outgrowth of a symposium organized by the editors at the American Chemical Society Meeting in August, 1994. The 37 chapters of the overall volume represent contributions from different symposium participants. As one would expect from an edited volume of this type, a wide variety of topics are covered with considerable variations in style between the chapters. Nevertheless, the editors have nicely organized the volume into a sensible grouping of different contributions. The chapters are generally well-written, and include appropriate references so that readers can easily fill in the gaps in their own understanding. Many of the chapters focus on the synthesis of new materials. As an example, one chapter focuses on the synthesis and polymerization of monomers containing clusters of three metal atoms. Other chapters concentrate on the catalytic, electrical, magnetic optical, or ion-exchange properties of metal-containing polymers. A particularly interesting section on biological systems includes an extensive review of transition metal-containing biopolymers. Another section covers recent advances in the synthesis and properties of silicon-containing polymers, and an introductory chapter provides a very useful overview of the general field of metal-containing polymers. Overall, the book provides an excellent snapshot of the current state of this field, and can be digested by anyone with some previous exposure to polymer chemistry. The text is most appropriate for established polymer scientists who are interested in keeping up-to-date with this field, or who would like to learn more about it. Readers in these categories will find this volume to be a very useful and readable reference work.

Reviewer: *Kenneth R. Shull is an assistant professor in the Materials Science and Engineering Department at Northwestern University. His research interests center on polymer interfaces, with a current emphasis on polymer adhesion. His interest in metal-containing polymers arises from work he has done on the properties of metal particle dispersions in polymeric matrices.*

Solid State Electrochemistry

Peter G. Bruce
(Cambridge University Press, New York, 1997)
xvi + 344 pages
$64.95 Cloth, ISBN 0-521-40007-4
$39.95 Paper, ISBN 0-521-59949-0

Solid State Electrochemistry, edited by P.G. Bruce, has been published in the series *Chemistry of Solid State Materials* of Cambridge University Press. It consists of 11 chapters (articles) written by 12 authors. Quoting the editor, the book aims to provide the essential foundation of solid state electrochemistry on a postgraduate level. Beyond the first three chapters, which are basically introductory in the sense that they describe solid electrolytes and their relevant properties, electrolyte materials design is treated (stressing polymers) in addition to ion transport with special emphasis on glass and polymers.

The electrochemical processes at the electrode/electrolyte interface are dealt with conventionally in two relatively short chapters entitled, "Electrode Performance" and "Interfacial Electrochemistry." The last chapter, which is on applications, gives a bird's eye view on solid state batteries, fuel cells, sensors, and several other devices. The first sentence of the book ensures that "this book describes for the first time in a modern text the fundamental principles on which solid state electrochemistry is based," which obviously is overstating. No doubt, some chapters extensively discuss the electrochemistry of polymers, for example. On the other hand, the electrochemical aspects of metal oxidation or solid state reactions in ionic crystals, which by nature are electrochemical processes, are not considered. Zeolites are not found in the index.

Some helpful chapters give, on somewhat different levels of sophistication, general overviews (e.g., "General Consideration, Major Material" and "Material Design"). Others are useful because, on a postgraduate level, they present the authors' view on and expertise in their research field, which is to some extent reflected in the references (e.g., chapter 5; chapter 6, "Polymer Electrolytes"; chapter 9, "Polymer Electrodes"; and chapter 7, "Insertion Electrodes"). The chapter on glass, which covers only a part of current activities, exemplifies this limitation. Redundancies, mainly from the conceptual point of view, cannot always be avoided in a book written by a dozen authors.

If one likes individual preferences and thorough descriptions by experts, here is an interesting book on solid state electrochemistry, illustrated on a postgraduate level in its most important chapters. If one prefers a conceptually homogeneous, carefully elaborated monograph on solid state electrochemistry, there will be others.

Reviewer: *H. Schmalzried, a professor at the Universität Hannover, Germany, has research interests in the areas of solid state thermodynamics, solid state reactions, and solid state electrochemistry.*

Fragile Objects: Soft Matter, Hard Science, and the Thrill of Discovery

P-G. De Gennes and J. Bandoz, translated by A. Reisinger
(Springer-Verlag, New York, 1996)
205 pages, $24.00
ISBN 0-387-94774-4

This marvelous book is a result of a crusade lecturing across the French-speaking world of high schools in which P-G. de Gennes engaged himself, after he received the Nobel Prize in physics in 1991, due to numerous invitations from students, science clubs, and high schools. In this book he talks in an elegant and most simple way about his science (soft matter), about the work of a scientist, and about the role of education and science in the modern world. Every section finishes with very exciting discussions, probing questions from the young students, and the lecturer's spontaneous responses.

Soft matter (*Matière Fragile* in French)