

**Poly(arylene ethynylene)s: From Synthesis to Application. *Advances in Polymer Science*, Volume 177.** Edited by Christoph Weder (Case Western Reserve University). Springer: Berlin, Heidelberg, New York. xii + 272 pp. \$226.00. ISBN 3-540-23366-0.

Conjugated polymers are currently at the forefront of polymer science, where interest in them stems from their strong potential to be developed into a variety of advanced materials with applications in electronic, optoelectronic, and optical devices. When considering conjugated polymers, one typically first thinks of poly(phenylene vinylene) or polythiophene (PPV and PT, respectively). These materials have been the focus of much scientific research, because of their history in the area of polymer light-emitting devices (PPV) and in organic semiconductors (PT). Although having received less attention, the poly(phenylene ethynylene)s (PPEs) also possess interesting and potentially useful optical and electronic properties. This book provides a highly useful snapshot view of the field of PPEs as it stands today. It should serve as an excellent resource for active researchers as well as for beginning students interested in learning more about conjugated polymers and PPEs in particular.

The book consists of a series of chapters written by leading academic scientists whose research has focused on the synthesis, properties, and applications of PPE-type conjugated polymers and oligomers. Although the volume is not a "one-stop-shop" for beginners who need to learn everything about the area of conjugated polymers, it will serve as a resource for those interested in becoming familiar with aspects of this specialized set of conjugated materials. Overall the choice of authors and topics is good; most of the leading groups in the area are represented within the monograph. The chapters are relatively consistent with respect to writing style and depth. The quality of the printed book is excellent; the copy is clear, and the technical preparation of the book is well done. In addition to the printed volume, the publisher also provides institutions that have a standing subscription to *Advances in Polymer Science* access to an electronic version of the text. By navigating (with some difficulty) through the Springer site to the series, one can download pdf files that contain the original text of each chapter in page-layout view.

The book begins with a chapter by Bunz that provides an overview of poly(arylene ethynylene)s, with an emphasis on synthesis and structure from the perspective of a synthetic organic/polymer chemist. The chapter contains a number of very useful tables that allow the reader to scan quickly the many different PPEs that have been prepared by various groups over the past several years. The repeat unit structure is provided, along with reagents and conditions used for the synthesis and an entry listing the primary literature citation(s) for the work. This style of presentation follows that used in several previous reviews and chapters authored by Bunz that have been highly cited, and it seems likely that the current chapter will be equally useful to workers in the field.

In the next chapter, Klemm and co-workers provide a concise review of the poly(arylene ethynylene)s that contain transition metal units. The chapter is organized into sections involving the various categories of metal-containing polymers, with an emphasis given to structures and synthesis, although some information is provided concerning properties, such as UV-visible absorption. The focus is on systems that contain chelating ligands such as bipyridine and terpyridine, but examples of PPE-type polymers that contain ferrocene and cyclobutadiene-cobalt complexes are also included.

Ray and Moore are the authors of Chapter 3, which highlights work carried out over the past several years by the Moore group on *meta*-linked PPE-type oligomers and related systems. This chapter gives a good introduction into the area of helical self-assembly in *meta*-linked PPE systems. The concept is explored from several avenues, including the use of optical absorption, circular dichroism, and fluorescence spectroscopy to probe the folding process. More recent work from the group is also reviewed, including guest-binding, guest-induced folding, and imine-metathesis polymerization in helical self-assembling materials. This chapter is one of the best overall reviews of work from the Moore lab that this reviewer is aware of.

The fourth chapter by Zheng and Swager is a discussion of sensor applications of PPE-type polymers. This group pioneered this field, where the fluorescence of a conjugated polymer is used to signal the presence of a target analyte with very high sensitivity. The basic concepts related to the use of fluorescent conjugated polymers as platforms for sensors are reviewed, and a number of specific systems that have been developed to target particular categories of analytes are covered. A section of the chapter is devoted to the application of water-soluble fluorescent polymers as biosensors. Because this area has been particularly active in the past several years, this section should be of wide interest to those interested in biosensors.

Yamamoto, Yamaguchi, and Yasuda provide a nice overview of PPE-type polymers that contain heteroaromatic groups in the conjugated backbone. This chapter is devoted mainly to structure and synthesis with a format that includes a number of tables summarizing structures, synthetic conditions, and optical properties (absorption and fluorescence). It should be useful to those seeking to learn about the scope of different PPEs that are known and the reaction conditions needed for their synthesis.

Finally, the book ends with an excellent chapter by Voskerician and Weder that focuses on the electronic (semiconductor) properties of poly(arylene ethynylene)s. This chapter provides an outstanding overview of the interesting properties of the materials of this class of conjugated polymers, and how

they can be used in applications ranging from organic thin film transistors to light-emitting diodes. It is a very useful review of this field and should catch the interest of many scientists working in the area.

Overall I enjoyed reading this book. It should belong to the library of any research institution where there is an interest in the chemistry of organic materials. Many researchers active in the field may also benefit by having a copy on their bookshelf. My one criticism of the book is its lack of a beginning chapter that gives some of the basic principles governing this family of

materials, e.g., structure, bonding, conformation, etc., and that contrasts the PPE-family with other classes of indirect gap conjugated polymers. Such an introduction would be particularly useful for introducing this area of polymer science to graduate students and others who are just entering the field.

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