

Polymer Chemistry: An Introduction, Third Edition

By Malcolm P. Stevens, Oxford University Press, New York, 1999, 551 pp., \$76.00.

Many introductory polymer chemistry textbooks face the challenge of balancing breadth and depth. This is because polymer chemistry can be subdivided into many sub-disciplines that all deserve proper treatment in a single introductory class, yet detail and depth must be sacrificed if all facets of the field are to be introduced. As the author of *Polymer Chemistry: An Introduction* points out in the preface, "Polymer chemistry is a marvelous subject. It draws upon all the traditional subdivisions of chemistry: organic, inorganic, physical, analytical, and biochemistry."

This textbook attempts to cover most aspects of polymer chemistry, and, therefore, detailed analysis of some topics is minimized. However, on the whole, *Polymer Chemistry: An Introduction* is a good broad-based textbook. The book is organized into three parts: Polymer Structure and Properties, Vinyl Polymers, and Non-Vinyl Polymers.

After an introduction to the rudimentary polymer concepts (Chapter 1, Basic Principles), the first part deals with polymer structure in solution (Chapter 2, Molecular Weight and Polymer Solutions) and in the solid-state (Chapter 3, Chemical Structure and Polymer Morphology). The author goes on to a description of polymer structure-property relationships (Chapter 4, Chemical Structure and Polymer Properties), and finishes with polymer characterization (Chapter 5, Evaluation, Characterization, and Analysis of Polymers). This part of the textbook introduces the student to the general nature of polymers, the evaluation of polymer molecular weight, some common polymer properties, and concepts such as polymer crystallinity and the glass transition temperature.

Part two begins with the synthetic aspects of polymer chemistry as they relate to the preparation of vinyl polymers (such as, polystyrene, polyethylene, and polyvinylalcohol). The author begins traditionally with free radical polymerization (Chapter 6, Free Radical Polymerization), combines anionic and cationic polymerization (Chapter 7, Ionic Polymerization), and then discusses metal-catalyzed polymerizations (Chapter 8, Vinyl Polymerization with Complex Coordination Catalysts). Copolymerizations, often dedicated to a whole chapter, are discussed within each of the polymerization processes. Because the author has focused on broadness, there are some topics that are not as developed as others. For example, Chapter 6 would have benefited from more coverage on newly-developed controlled free radical polymerization and emulsion polymerization (about one page is devoted to each topic). In Chapter 8 the author gives an overview of Ziegler/Natta, metallocene and metathesis polymerization of olefins and cyclic olefins. Part two finishes with a description of polymer modification reactions (Chapter 9, Reactions of Vinyl Polymers).

Part three "Nonvinyl Polymers" attempts to cover the balance of polymer chemistry. After a one-chapter introduction to the general features of both condensation and ring-opening polymerization (Chapter 10, Step-Reaction and Ring-Opening Polymerization), the author devotes the next six chapters to different polymer types within these two polymerization classes (Chapter 11, Polyethers, Polysulfides, and Related Polymers; Chapter 12, Polyesters; Chapter 13, Polyamides and Related Polymers; Chapter 14, Phenol-, Urea-, and Melamine-Formaldehyde Polymers; Chapter 15, Heterocyclic Polymers; Chapter 16, Inorganic and Partially Inorganic Polymers). These chapters essentially survey their respective sub-fields with some synthetic chem-

istry, polymer properties, and applications. Chapter 17 is entitled "Miscellaneous Organic Polymers" and according to the author, "This is by no means to be considered an exhaustive compilation of 'miscellaneous' organic polymers, but it does include (not necessarily in any logical sequence) most of the polymer types that have received fairly extensive treatment in the polymer literature." The book ends with a descriptive chapter on naturally occurring polymers (Chapter 18, Nature Polymers).

Of the three appendices ((A) Commonly Used Polymer Abbreviations; (B) Polymer Literature; and (C) Sources of Laboratory Experiments in Polymer Chemistry), C is the most useful. There is a long list of polymer-related experiments or demonstrations published in the *Journal of Chemical Education* between 1950 and 1997. Also, many of the review exercises found at the end of each chapter contain literature references. This is a nice feature that should encourage students to explore the original polymer literature when interested.

The author suggests that this textbook should be used for a course in polymer chemistry at the advanced undergraduate or beginning graduate level. Also, the author states that this text should serve as an introduction to the field for the industrial chemist with no prior training in polymer chemistry or as a reference source for the practicing polymer chemist. In my opinion, this text is a very good introductory text for senior undergraduates or beginning graduate students who will take only one course in polymer chemistry. The writing style is clear and most relevant topics in polymer chemistry are covered to some degree. This book, like many others, emphasizes the breadth of polymer chemistry and does so very nicely.

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