ChE **book review**

FUNDAMENTAL PRINCIPLES OF POLYMERIC MATERIALS, 2nd edition.

by Stephen L. Rosen
Wiley Interscience, 420 pages (1993)

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This book is a revised version of the book with the same title that was published in 1981. The major target audience would be senior-level undergraduate chemical engineering students and industrial engineers who do not have prior background in polymers but who do have fundamental chemical engineering knowledge.

One visible change in the revised edition is that many exercise problems have been added to each chapter. With fully worked-out example problems, the addition of these exercise problems makes the book attractive as a textbook. While there are several undergraduate-level textbooks on polymer science and engineering, this one stands out because of these examples and exercise problems. Undergraduate students, in general, like textbooks with many examples.

The style of the author's writing is more like that of a classroom lecture. Many interesting and humorous examples and analogies are sprinkled throughout to help readers understand difficult basic concepts. I found the reading of this book very entertaining. The materials are presented in a very concise manner and important physical and chemical concepts are presented clearly. For senior-level chemical engineering students or practicing engineers with appropriate knowledge in reaction kinetics, thermodynamics, and mathematics, there should be no problem in studying this book with very little help.

The book consists of our parts: Polymer Fundamentals, Polymer Synthesis, Polymer Properties, Polymer Technology. The first part comprises seven chapters that cover types of polymers, bonding in polymers, stereoisomerism, polymer morphology, characterization of molecular weight, polymer solubility and solutions, and transitions in polymers. It should be noted that conceptual understanding of difficult concepts has been stressed throughout the book, and the manner in which the subject materials are presented is excellent. For example, in Chapter 8 ("Polymer Solubility and Solutions"), the concepts of Flory-Huggins model, solubility parameter, and its physical significance are explained in easy-to-understand language with minimal use of mathematical equations. This approach has an advantage in that students are not overwhelmed by complex mathematical derivations.

In the second part ("Polymer Synthesis"), both step growth and chain growth polymerization kinetics are discussed. The depth of the theoretical discussion of these topics is adequate, and a few numerical examples are also presented. In the chain growth polymerization part, heterogeneous polymerization systems including emulsion polymerization and transition metal catalyzed olefin polymerization are discussed in some detail. In particular, olefin polymerization kinetics, which in many other textbooks are not well covered, are presented with some recent literature on the topic.

Chapter 13 is devoted to the discussion of industrial polymerization processes. This chapter is somewhat short, but descriptive, and the examples chosen by the author are good in that the students can understand the process characteristics using the knowledge gained in earlier chapters of Part 2. This chapter offers some interesting problems for senior students looking for problems for their design courses.

Part 3 covers rubber elasticity, viscous flow, viscometry and tube flow, continuum mechanics, and linear viscoelasticity. In general, senior undergraduate students take elementary transport phenomena courses before taking the polymer course—thus the theoretical development in polymer solution or melt rheology in Part 3 looks quite reasonable for those students. Chapter 17 ("Introduction to Continuum Mechanics") is shorter than other chapters, but it offers enough advanced material for the book's readers to think about. Chapter 18 on linear elasticity is quite thorough and serves as an excellent reference for basic theories of linear elasticity.

Finally, in Part 4, various topics related to polymer processing, plastics, rubber, synthetic fibers, surface finishes, and adhesives are discussed in a descriptive manner. Although many of the chapters in Part 4 are short, each one gives a good list of pertinent literature for more advanced study.

In summary, the book is an excellent textbook covering almost all the basic materials for senior-level undergraduate chemical engineering students. The strengths of the book can be found in its coverage of a wide variety of important topics, its well-organized presentation, its few typographical errors, its technical accuracy, its many worked-out examples and exercise problems, and its reader-friendly writing style. All of the book's subjects can be easily covered in an one-semester, three-hours/week course. As Professor Rosen states in its preface, the book can serve successfully as a textbook as well as a self-study guide for practicing engineering and scientists. No solution manual is available for instructors, but a two-page errata (typographical) is available from the author. ❐