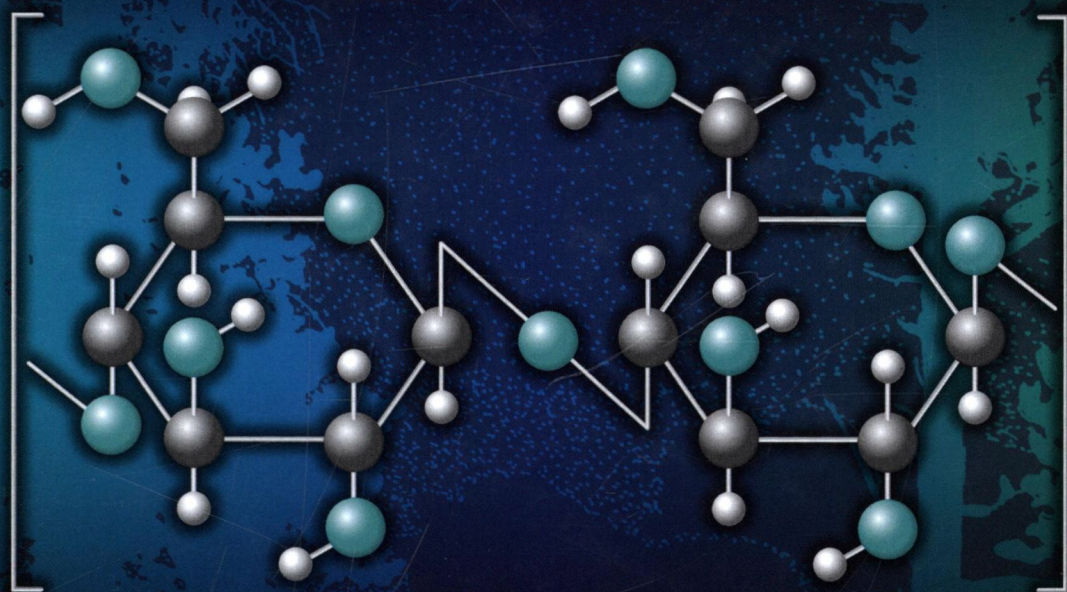


Carragher's Polymer Chemistry

TENTH EDITION



Charles E. Carragher, Jr.



CRC Press
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Carraher's TENTH EDITION Polymer Chemistry

Updated to reflect a growing focus on sustainable, medicinal, and industrial chemistry, **Carraher's Polymer Chemistry, Tenth Edition** provides a user-friendly approach to the fundamental principles that contribute to the understanding and growth of polymer science and to our ever increasingly complex world.

With a continued emphasis on the environment and green chemistry, the latest edition features newly added sections on photochemistry and green materials. This book includes additional property tables, updated techniques and increased coverage of topics including butyl rubber, photophysics, shear-thickening fluids and more. The emphasis on nanotechnology, nanomaterials, and nanoscale behavior has also been expanded.

The author begins most chapters with theoretical information followed by applications, and generally addresses the most critical topics first. Special sections in each chapter contains definitions, learning objectives, questions, and additional reading. Suitable as an undergraduate as well as graduate-level text, this book provides the necessary elements of an introductory text, covering synthesis, properties, applications, and characterization. **Carraher's Polymer Chemistry, Tenth Edition** allows students to integrate their chemical knowledge and establish a connection between fundamental and applied chemical information. It meets the American Chemical Society Committee on Professional Training guidelines for use in an advanced course and required coverage in macromolecular (polymers), supramolecular, and nanoscale systems.



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Tenth Edition

Preface

As with most sciences, and chemistry in particular, there is an explosive broadening and increase in the importance of the application of the foundational principles of polymers. This broadening is seen in ever-increasing vistas allowing the advancement of our increasingly technologically dependent society and solutions to society's most important problems in areas such as the environment and medicine. Some of this broadening is the result of the extended understanding and application of already-known principles, but it also includes the development of basic principles and materials known to us hardly a decade ago. Most of the advancements in communication and computers, medicine, and air and water purity are tied to macromolecules and the fundamental understanding of the principles that govern their behavior. Much of this revolution is of a fundamental nature and is explored in this latest edition. This book contains these basic principles as well as touches upon their application to real-life situations. Technology is the application of scientific principles. In polymers, there is often little, if any, division between science and technology.

The importance of the environment and our interaction with it is becoming increasingly evident. Industry is increasingly emphasizing green science and practices that are favorable to the environment. Polymer science is part of this increased emphasis and contributes critical components to solutions. This book continues to emphasize these measures, including special sections that deal directly with environmental issues as well as integrating green science appropriately woven within the fabric that is polymer chemistry. Consistent with the continued emphasis on green chemistry, new sections that deal with photochemistry and green materials have been added.

Polymers are found in the organic natural world as building blocks for life itself. They are also found as inorganic building blocks that allow the construction of homes, skyscrapers, and roads. Synthetic polymers serve as basic building blocks of society today and tomorrow. This book includes all three of these critical segments of polymeric materials.

A basic understanding of polymers is essential to the training of today's science, biomedical, and engineering students. This book complies with the American Chemical Society's Committee on Professional Training guidelines as an advanced or in-depth course. It naturally integrates and interweaves the important foundational areas, since polymers are critical to all of the foundational areas, with all of these foundational areas contributing to the growth of polymer science. Most of the fundamental principles of polymers extend and enhance similar principles found throughout the undergraduate and graduate training of students. This allows students to integrate their chemical knowledge, illustrating the connection between fundamental and applied chemical information. Thus, along with the theoretical information, application is integrated as an essential part of the information. As in other areas such as business and medicine, short case studies are integrated as historical material.

While this book is primarily written as an introductory graduate-level text, it can also be used as an undergraduate text, or as an introductory undergraduate–graduate text. The topics are written so that the order and inclusion or exclusion of chapters or parts of chapters will still allow the students an adequate understanding of the science of polymers. Most of the chapters are written beginning with the theory followed by application. The most important topics are generally at the beginning of the chapter followed by important, but less critical, sections. Some will choose to take the synthesis-intensive chapters first, others will take the analytical/analysis/properties chapters first, and others will simply take the chapters as they appear in the text. The book contains all of the elements of an introductory text with synthesis, property, application, and characterization all present, allowing this to be the only polymer course taken by an individual or the first in a series of polymer-related courses taken by a student.

This edition continues in the “user-friendly” mode with special sections in each chapter containing definitions, learning objectives, questions, and additional reading. Application and

theory are integrated so that they reinforce one another. There is a continued emphasis on picturing, reinforcing, interweaving, and integrating the basic concepts. The initial chapter is shorter, allowing the students to become acclimated. Other chapters are written so they can be covered in about a week's time or less. Where possible, difficult topics are distributed and reinforced over several topics. Case studies are woven into the text fabric.

The basic principles that apply to synthetic polymers apply equally well to inorganic and biological polymers and are present in each of the chapters covering these important polymer groupings.

The updating of analytical, physical, and special characterization techniques continues. The coverage of a number of topics has been increased, including carbon nanotubes, tapes and glues, butyl rubber, polystyrene, polypropylene, polyethylene, poly(ethylene glycols), shear-thickening fluids, photochemistry and photophysics, dental materials, and aramids. Expanded sections on a number of copolymers have been added, including fluoroelastomers, nitrile rubbers, acrylonitrile–butadiene–styrene terpolymers, and EPDM rubber. New units on spliceosomes, asphalt, and flyash and aluminosilicates have been included. The emphasis on the molecular behavior of materials, that is, nanoscale behavior, has been expanded as has been the emphasis on nanotechnology and nanomaterials. PowerPoint presentations, instructor materials, and test banks will be hosted on a companion website. Visit the book's CRC Press website for further details: <http://www.crcpress.com/9781498737388>. Advanced material to accompany this textbook can be found on the CRC Press Website at <http://www.crcpress.com/9781498737388>.

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Comments on Pictures: Other than pictures of several of the polymer pioneers taken from Wikipedia, the pictures were taken by the author with the exception of the picture of the sheep that was taken by Barbara Knott. The objects are intended, for the most part, to be items of general familiarity to the reader, illustrating the prevalence of polymers in our everyday life. I thank Home Depot (Coconut Creek, Florida) and Walmart (Coconut Creek, Florida) for allowing me to take pictures. I also thank Cara Carraher and Erin Carraher for their help with directions as to how to take better pictures.

Author

Charles E. Carraher, Jr., is a professor of chemistry and biochemistry at Florida Atlantic University, Boca Raton. He has been recognized as the Outstanding Chemist in Southeast USA (1992) by the American Chemical Society (ACS) and is the recipient of a distinguished service award for his efforts in science education (1995) from the ACS's Divisions of Polymer Chemistry and Polymeric Materials: Science and Engineering. He is a fellow of the American Institute of Chemists (1975), Polymeric Materials (2006), Polymer Chemistry (2010), and the American Chemical Society (2010). Currently, he serves as cochair of the ACS's Joint Polymer Education Committee, is on the board of the Intersocietal Polymer Education Committee, and has been a member of the ACS's Committee on Professional Training (CPT). He is an associate editor of the *Journal of Polymeric Materials* and is on the board of the *Journal of Inorganic and Organometallic Polymers and Materials* and the *Journal of Chinese Advanced Materials Society*. He has authored or coauthored over 75 books and over 1100 articles and has chaired/cochaired numerous national and international symposia. His research has led to the synthesis of over 85 new families of polymers. In 1984, he received the Outstanding Scientist and Engineering Award from the Engineers and Scientists Affiliate Societies Council for his work in science education and research, and in 1992, he received the Saltarilli Sigma Xi Award for his research efforts. Dr. Carraher was the recipient of the 2002 Distinguished Researcher Award from Allied Technologies; award for Outstanding Contributions in Polymer Chemistry from the Division of Polymer Chemistry in 2016; and award for Outstanding Contributions in Polymeric Materials and Engineering from the Division of Polymeric Materials: Science and Engineering in 2017.

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