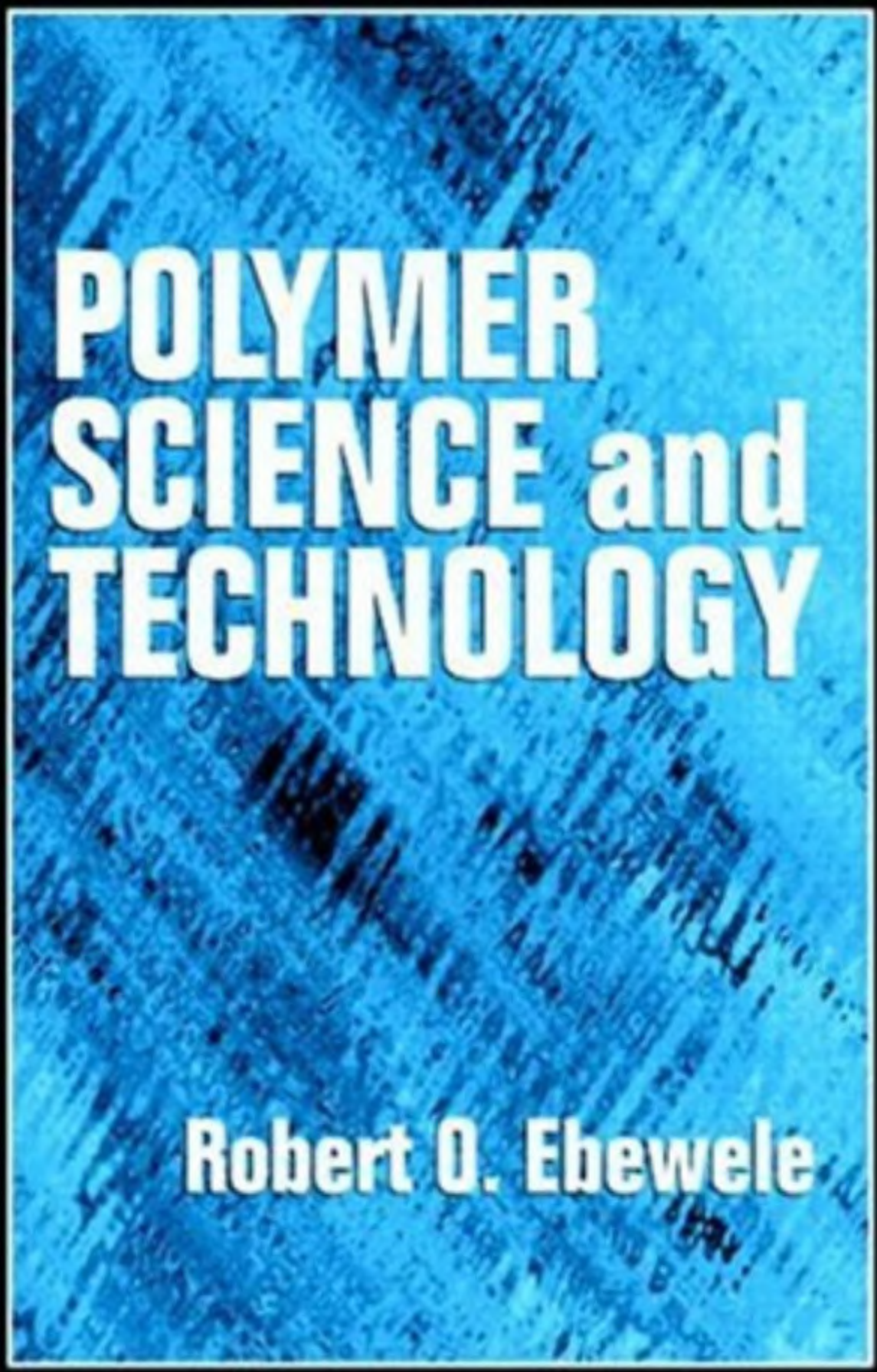
POLYMER
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PREFACE

The book is divided into three parts. The first part covers polymer fundamentals. This includes a brief discussion of the historical development of polymers, basic definitions and concepts, and an overview of the basis for the various classifications of polymers. It also examines the requirements for polymer formation from monomers and discusses polymer structure at three levels: primary, secondary, and tertiary. The relationship between the structure of the monomers and properties of the resulting polymer is highlighted. This section continues with a discussion of polymer modification techniques. Throughout the discussion, emphasis is on the structure-property relationship and several examples are used to illustrate this concept.

The second part deals with how polymers are prepared from monomers and the transformation of polymers into useful everyday articles. It starts with a discussion of the various polymer preparation methods with emphasis on reaction mechanisms and kinetics. The control of molecular weight through appropriate manipulation of the stoichiometry of reactants and reaction conditions is consistently emphasized. This section continues with a discussion of polymer reaction engineering. Emphasis is on the selection of the appropriate polymerization process and reactor to obtain optimal polymer properties. The section terminates with a discussion of polymer additives and reinforcements and the various unit operations in polymer processing. Here again, the primary focus is on how processing conditions affect the properties of the part produced.

The third part of the book deals with the properties and applications of polymers. It starts with a discussion of polymer solution properties through the mechanical properties of polymers and concludes with an overview of the various applications of polymer materials solids. The viscoelastic nature of polymers is also treated. This section also includes a discussion of polymer fracture. The effects of various molecular and environmental factors on mechanical properties are examined.

The primary focus of the book is the ultimate property of the finished polymer product. Consequently, the emphasis throughout the book is on how various stages involved in the production of the finished product influence its properties. For example, which polymerization process will be preferable for a given monomer? Having decided on the polymerization process, which type of reactor will give optimum product properties? What is the best type of processing technique for a given polymer material? How do processing conditions affect the properties of the part produced and which polymer material is most suitable for a particular application? The book addresses the elements that must be considered to come up with appropriate answers to these types of questions. The distinguishing features of the book are intended to address certain problems associated with teaching an elementary course in polymers:

1. For a vast majority of introductory polymer courses, very frequently the instructor has to rely on several textbooks to cover the basics of polymers as none of the existing textbooks discusses the required materials satisfactorily. Most students find dealing with several textbooks in an introductory course problematic. This book attempts to remedy this problem. A deliberate effort has been made to cover most of the areas normally taught in such an introductory course. Indeed, these areas are typical of existing texts. However, the approach and depth of coverage are different. The book presents various aspects of polymer science and technology in a readily understandable way. Emphasis is on a basic, qualitative understanding of the concepts rather than rote memorization or detailed mathematical analysis. Description of experimental procedures employed in the characterization of polymers has been either completely left out or minimized. I strongly believe that this approach will appeal to those students who will be learning polymer science for the first time.
2. None of the existing texts has worked examples. It is my experience that students feel more comfortable with and generally prefer textbooks that illustrate principles being discussed with examples. I have followed this approach throughout the text. In addition, each chapter has review problems; answers are provided in a Solutions Manual. Both the worked examples and the review problems are designed to provide additional insight to the materials covered. The overall objective of this approach is to enhance the reader's understanding of the material and build his/her confidence. Emphasis throughout the book is on structure-property relationship and both the worked examples and review problems reflect this basic objective.

Robert O. Ebewele

ACKNOWLEDGMENT

In writing this book, I have had to rely on materials from various sources. These sources have been compiled as references at the end of each chapter. While I express my profound gratitude to publishers for permission to use their materials, I apologize for ideas and materials which I have inadvertently failed to acknowledge. I certainly do not lay claim to these published concepts and ideas.

The skeletal framework for this book was initiated during my student days at the University of Wisconsin, Madison and over the years, the material in the book has been constantly refined as it was being developed for use by successive generations of undergraduate and graduate students at the Ahmadu Bello University, Zaria, Nigeria. The final version of the book was written during my sabbatical leave at the Department of Chemical Engineering, University of Wisconsin, Madison, and subsequently during my leave of absence at the Forest Products Laboratory Madison, Wisconsin. I am grateful to the Ahmadu Bello University, Zaria, the University of Wisconsin, Madison and the Forest Products Laboratory, Madison for providing me unlimited access to their library materials and other facilities. Finally, I am indebted to the late Prof. J. A. Koutsky of the University of Wisconsin, Madison; Dr. George E. Myers and Mr. Bryan H. River, formerly of the Forest Products Laboratory, Madison; and a host of others for reviewing various parts of this book. Your contributions have greatly improved the quality of the book. I, however, take full responsibility for any lapses and errors that may be contained in the book.

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