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This high school textbook introduces polymer science basics, properties, and uses. It starts with a broad overview of synthetic and natural polymers and then covers synthesis and preparation, processing methods, and demonstrations and experiments. The history of polymers is discussed alongside the s A highly readable introductory textbook on polymer science, ideal for those requiring a broad overview of the subject. Recent advances on special topics in polymer chemistry and polymers and the environment are included. "Highly recommended!" - CHOICE New Edition Offers Improved Framework for Understanding Polymers Written by well-established professors in the field, Polymer Chemistry, Second Edition provides a well-rounded and articulate examination of polymer properties at the molecular level. It focuses on fundamental principles based on underlying chemical structures, polymer synthesis, characterization, and properties. Consistent with the previous edition, the authors emphasize the logical progression of concepts, rather than presenting just a catalog of facts. The book covers topics that appear prominently in current polymer science journals. It also provides mathematical tools as needed, and fully derived problems for advanced calculations. This new edition integrates new theories and experiments made possible by advances in instrumentation. It adds new chapters on controlled polymerization and chain conformations while expanding and updating material on topics such as catalysis and synthesis, viscoelasticity, rubber elasticity, glass transition, crystallization, solution properties, thermodynamics, and light scattering. Polymer Chemistry, Second Edition offers a logical presentation of topics that can be scaled to meet the needs of introductory as well as more advanced courses in chemistry, materials science, and chemical engineering. An Introduction to Polymer Chemistry focuses on the fundamental chemistry of synthetic organic polymers of high molecular weight. This book explains the basic principles of polymer chemistry, from significant methods of molecular weight determination to the simpler mechanisms of polymerization. The osmotic, light scattering, and viscosity methods of molecular weight determination are fully discussed together with the kinetics of selected examples of condensation and free-radical addition polymerization. The main features of ionic polymerization are also elaborated. This text, however, does not cover the thermodynamics of polymer solutions or the methods of structure determination. This publication is a good reference to university and technical college students researching on polymer chemistry. Natural polymers, such as proteins, starch, cellulose, hevea rubber, and gum which have been available for centuries, have been applied as materials for food, leather, sizings, fibers, structures, waterproofing, and coatings. During the past century, the use of both natural and syn thetic polymers has been expanded to include more intricate applications, such as membranes, foams, medicinals, conductors, insulators, fibers, films, packaging and applications requiring high modulus at elevated temperatures. The topics in this symposium which are summarized in this book are illustrative of some of the myriad applications of these ubiquitous mater ials. As stated in forecast in the last chapter in this book, it is cer tain that revolutionary applications of polymers will occur during the next decades. Hopefully, information presented in other chapters in this book will catalyze some of these anticipated applications. It is appropriate that these reports were presented at an American Chemical Society Polymer Science and Engineering Division Award Symposium honoring Dr. O.A. Battista who has gratifying to note that Phillips Pet roleum Company, which has paved the way in applications of many new poly mers, is the sponsor of this important award. We are all cheerfully expressing our thanks to this corporate spon sor and to Distinguished Professor Raymond B. Seymour of the University of Southern Mississippi who served as the organizer of this symposium and editor of this important book. Contents: Preface; Historical Introduction; Types Of Polymeric Substances; Molecular Size And Chemical Reactivity; Polymerization Of Unsaturated Monomers By Free Radical Mechanisms; Copolymerization, Emulsion Polymerization And Ionic Polymerization; The Structure Of Vinyl Polymers; Determination Of Molecular Weights; Molecular Weight Distributions In Linear Polymers; Molecular Weight Distributions In Nonlinear Polymers And The Theory Of Gelation; Configuration Of Polymers Chains; Rubber Elasticity; Statistical Thermodynamics Of Polymers Solutions; Phase Equilibria In Polymer Systems; Configurational And Prictional Properties; Index; Etc. There are examples aplenty in the macroscopic world that demonstrate the form of objects directing their functions and properties. On the other hand, the fabrication of extremely small objects having precisely defined structures has only recently become an attractive challenge, which is now opening the door to nanoscience and nanotechnology. In the field of synthetic polymer chemistry, a number of critical breakthroughs have been achieved during the first decade of this century to produce an important class of polymers having a variety of cyclic and multicyclic topologies. These developments now offer unique opportunities in polymer materials design to create unprecedented properties and functions simply based on the form, i.e. topology, of polymer molecules. In this book on topological polymer chemistry, the important developments in this growing area will be collected for the first time, with particular emphasis on new conceptual insights for polymer chemistry and polymer materials. The book will systematically review topological polymer chemistry from basic aspects to practice, and give a broad overview of cyclic polymers covering new synthesis, structure characterization, basic properties/functions and the eventual applications. This book has been designed to appeal to both chemists working in, and new to, the area of polymer synthesis. It contains detailed instructions for the preparation of a wide-range of polymers by a wide variety of different techniques, and describes how this synthetic methodology can be applied to the development of new materials. It includes details of well-established techniques, e.g. chain-growth or step-growth processes together with more up-to-date examples using methods such as atom-transfer radical polymerisation. Less-well known procedures are also included, e.g. electrochemical synthesis of conducting polymers and the preparation of liquid crystalline elastomers with highly ordered structures. Other topics covered include general polymerisation methodology, controlled/'living' polymerisation methods, the formation of cyclic oligomers during step-growth polymerisation, the synthesis of conducting polymers based on heterocyclic compounds, dendrimers, the preparation of imprinted polymers and liquid crystalline polymers. The main bulk of the text is preceded by an introductory chapter detailing some of the techniques available to the scientist for the characterisation of polymers, both in terms of their chemical composition and in terms of their properties as materials. The book is intended not only for the specialist in polymer chemistry, but also for the organic chemist with little experience who requires a practical introduction to the field. This book provides a comprehensive introduction to the study of polymers. Special emphasis is given to the characteristics that set polymers apart from small molecules, as studied in classic chemistry courses. The various branches of polymer science are introduced and discussed in a systematic manner, starting from basic chemical structures, continuing through supermolecular organization and physical properties. Specific examples are used throughout to illustrate how end usage relates to the principles under discussion. A series of chapters is devoted to case studies

describing the principal classes of synthetic polymers. Content includes: - Polymerization - Characterization of Polymers - Rheological Description of Polymer Melts - Structural Development - Properties - Compounding and Extrusion Processes - Molding processes - Additional Methods of Manufacture - Commodity Polymers - Engineering Thermoplastics - Neat Stuff This book introduces the concepts of physical chemistry of polymers in a format targeted for a blended-learning approach. It provides a basis to bridge polymer chemistry, which targets microscopic chain structures, and polymer engineering, which targets macroscopic material properties and functions. Topics covered are single chain statistics, multi-chain interactions, and chain dynamics, both from a viewpoint of structure, properties (mostly mechanical ones), and their interrelation. In all that, the author encourages the reader to think conceptually. Explains complex facts through simplifying models, diagrams, and illustrations Accessible to chemists, chemical engineers, materials scientists, and physicists Tailored content for an interactive blended-learning format Carraher's Polymer Chemistry, Tenth Edition integrates the core areas of polymer science. Along with updating of each chapter, newly added content reflects the growing applications in Biochemistry, Biomaterials, and Sustainable Industries. Providing a user-friendly approach to the world of polymeric materials, the book allows students to integrate their chemical knowledge and establish a connection between fundamental and applied chemical information. It contains all of the elements of an introductory text with synthesis, property, application, and characterization. Special sections in each chapter contain definitions, learning objectives, questions, case studies and additional reading. This book provides a comprehensive introduction to the study of polymers. Special emphasis is given to the characteristics that set polymers apart from small molecules, as studied in classic chemistry courses. The various branches of polymer science are introduced and discussed in a systematic manner, starting from basic chemical structures, continuing through supermolecular organization and physical properties. Specific examples are used throughout to illustrate how end usage relates to the principles under discussion. A series of chapters is devoted to case studies describing the principal classes of synthetic polymers. The increasing demand for polymers with new structures and functions has inspired the development of new synthetic techniques. This book focuses on breakthroughs and progress in synthetic polymer chemistry, providing efficient tools for the synthesis of linear and topological polymers. Synthetic Polymer Chemistry will be a valuable reference for those working in polymer chemistry, as well as students and researchers interested in opto-electronic, biological and materials sciences. Thoroughly updated, Introduction to Polymers, Third Edition presents the science underpinning the synthesis, characterization and properties of polymers. The material has been completely reorganized and expanded to include important new topics and provide a coherent platform for teaching and learning the fundamental aspects of contemporary polymer science. New to the Third Edition Part I This first part covers newer developments in polymer synthesis, including 'living' radical polymerization, catalytic chain transfer and free-radical ring-opening polymerization, along with strategies for the synthesis of conducting polymers, dendrimers, hyperbranched polymers and block copolymers. Polymerization mechanisms have been made more explicit by showing electron movements. Part II In this part, the authors have added new topics on diffusion, solution behaviour of polyelectrolytes and field-flow fractionation methods. They also greatly expand coverage of spectroscopy, including UV visible, Raman, infrared, NMR and mass spectroscopy. In addition, the Flory-Huggins theory for polymer solutions and their phase separation is treated more rigorously. Part III A completely new, major topic in this section is multicomponent polymer systems. The book also incorporates new material on macromolecular dynamics and reptation, liquid crystalline polymers and thermal analysis. Many of the diagrams and micrographs have been updated to more clearly highlight features of polymer morphology. Part IV The last part of the book contains major new sections on polymer composites, such as nanocomposites, and electrical properties of polymers. Other new topics include effects of chain entanglements, swelling of elastomers, polymer fibres, impact behaviour and ductile fracture. Coverage of rubber-toughening of brittle plastics has also been revised and expanded. While this edition adds many new concepts, the philosophy of the book remains unchanged. Largely self-contained, the text fully derives most equations and cross-references topics between chapters where appropriate. Each chapter not only includes a list of further reading to help readers expand their knowledge of the subject but also provides problem sets to test understanding, particularly of numerical aspects. Introduction to Polymer Chemistry provides undergraduate students with a much-needed, well-rounded presentation of the principles and applications of natural, synthetic, inorganic, and organic polymers. With an emphasis on the environment and green chemistry and materials, this fourth edition continues to provide detailed coverage of natural and synthetic giant molecules, inorganic and organic polymers, elastomers, adhesives, coatings, fibers, plastics, blends, caulks, composites, and ceramics. Building on undergraduate work in foundational courses, the text fulfills the American Chemical Society Committee on Professional Training (ACS CPT) in-depth course requirement Basics of Polymer Chemistry is of great interest to the chemistry audience. The basic properties of polymers, including diverse fundamental and applied aspects, are presented. This book constitutes a basis for understanding polymerization, and it presents a comprehensive overview of the scientific research of polymers. The chapters presented can be used as a reference for those interested in understanding the sustainable development in polymers. Basics of Polymer Chemistry provides a balanced coverage of the key developments in this field, and highlights recent and emerging technical achievements. The topics covered present a comprehensive overview of the subject area and are therefore of interest to professors and students. The recent developments in polymerization using catalysts, homo and copolymerization are presented, and it contains current efforts in designing new polymer architectures. Improved property performance attributes of the polymers by controlling their molecular-structural characteristics such as molecular weight distribution, comonomer type content distribution, and branching level are also discussed. This text follows a broad sequence of preparation, characterization, physical and mechanical properties and structure-property relations. Polymers: Chemistry and Physics of Modern Materials, Second Edition covers several methods of polymerization, properties, and advanced applications such as liquid crystals and polymers used in the electronics industry. Topics also include Step-Growth, Free Radical Addition, and Ionic Polymerization; Copolymerization; Polymer Stereochemistry and Characterization; Structure-Property Relationship; Polymer Liquid Crystals; and Polymers for the Electronics Industry. This book deals with the organic chemistry of polymers which find technological use as adhesives, fibres, paints, plastics and rubbers. For the most part, only polymers which are of commercial significance are considered and the primary aim of the book is to relate theoretical aspects to industrial practice. The book is mainly intended for use by students in technical institutions and universities who are specializing in polymer science and by graduates who require an introduction to this field. There are available several books dealing with the physical chemistry of polymers but the organic chemistry of polymers has not received so much attention. In recognition of this situation and because the two aspects of polymer chemistry are often taught separately, this book deals specifically with organic chemistry and topics of physical chemistry have been omitted. Also, in this way the book has been kept to a reasonable size. This is not to say that integration of the two areas of polymer science is undesirable; on the contrary, it is important that the inter-relationship should be appreciated. I was gratified by the favourable comments prompted by the first edition of the book and I have therefore retained the same organization in this second edition. Nevertheless, the book has been extensively revised to reflect the developments which have taken place. Thiol-X chemistries are already well established techniques, but it is only recently that they have been exploited for the functionalization and synthesis of polymers and other materials. As such, information on these techniques is scattered across the literature and Thiol-X Chemistries in Polymer and Materials Science is the first book to compile work specifically focussing on the application of thiol-based chemistries in materials design and synthesis. The book introduces the various thiol-X chemistries currently available and applications where they have been successfully used, including examples of 'click' processes, in polymerizations, polymer synthesis, and polymer modification. Short 'how to' sections within the chapters also provide general experimental techniques to employ the various chemistries described. Written by leading experts in the field, this book is a comprehensive resource for postgraduates, academics and industrial practitioners interested in polymer and materials applications. 'An excellent textbook for an advanced undergraduate or introductory graduate course on polymer chemistry. ...The book is easy to read and understand. The emphasis on commercially important materials makes it a definite choice for a textbook.' - Microchemical Journal 'This excellent, well-written book, suitable for advanced undergraduates and graduate level classes in polymer syntheses, would also be useful as a general resource book....thoroughly referenced, and contain[s] excellent problem sets.' -Choice This outstanding text combines comprehensive discussions of reaction mechanisms of polymer chemistry with detailed descriptions of practical industrial applications. Intended for graduate students and professionals, this text examines topics at the forefront of today's research-including high performance materials, polymeric reagents and catalysts, and ultraviolet light curing of

polymeric coatings. Each chapter contains helpful review questions reinforcing key points. The book also features useful appendixes describing two highly applicable computer programs. There is, at present, no scarcity of polymer textbooks in the English language. Some of them attempt to cover the entire field, others focus their attention on certain parts of it, e.g., organic chemistry, physical chemistry, solid state physics, etc. This situation must necessarily raise the question, "Why publish another book?" and, even more, "Why translate a book which exists already in German?" and is to a lesser or greater extent legible and comprehensible to many English speaking scientists. It appears that a justification can be found in the special character of its content and presentation. As far as content is concerned, Vollmert's book is more encompassing than most existing treatises and, in this sense, almost represents a hybrid between a "textbook" and a "handbook." Numerous figures and tables convey directly a wealth of data. On the other hand, the text is designed to be educational and, in many instances, goes a long way to explain why certain properties are observed and why certain processes take place. These excursions into the intellectual clarification of somewhat complicated phenomena are a refreshing and unusual interruption of the main stream which presents synthesis, characterization and properties of polymeric systems in the classical way. This book provides a comprehensive description of topological polymers, an emerging research area in polymer science and polymer materials engineering. The precision polymer topology designing is critical to realizing the unique polymer properties and functions leading to their eventual applications. The prominent contributors are led by Principal Editor Yasuyuki Tezuka and Co-Editor Tetsuo Deguchi. Important ongoing achievements and anticipated breakthroughs in topological polymers are presented with an emphasis on the spectacular diversification of polymer constructions. The book serves readers collectively to acquire comprehensive insights over exciting innovations ongoing in topological polymer chemistry, encompassing topological geometry analysis, classification, physical characterization by simulation and the eventual chemical syntheses, with the supplementary focus on the polymer folding, invoked with the ongoing breakthrough of the precision AI prediction of protein folding. The current revolutionary developments in synthetic approaches specifically for single cyclic (ring) polymers and the topology-directed properties/functions uncovered thereby are outlined as a showcase example. This book is especially beneficial to academic personnel in universities and to researchers working in relevant institutions and companies. Although the level of the book is advanced, it can serve as a good reference book for graduate students and postdocs as a source of valuable knowledge of cutting-edge topics and progress in polymer chemistry. New edition brings classic text up to date with the latest science, techniques, and applications. With its balanced presentation of polymer chemistry, physics, and engineering applications, the Third Edition of this classic text continues to instill readers with a solid understanding of the core concepts underlying polymeric materials. Both students and instructors have praised the text for its clear explanations and logical organization. It begins with molecular-level considerations and then progressively builds the reader's knowledge with discussions of bulk properties, mechanical behavior, and processing methods. Following a brief introduction, *Fundamental Principles of Polymeric Materials* is divided into four parts: Part 1: Polymer Fundamentals Part 2: Polymer Synthesis Part 3: Polymer Properties Part 4: Polymer Processing and Performance Thoroughly Updated and Revised Readers familiar with the previous edition of this text will find that the organization and style have been updated with new material to help them grasp key concepts and discover the latest science, techniques, and applications. For example, there are new introductory sections on organic functional groups focusing on the structures found in condensation polymerizations. The text also features new techniques for polymer analysis, processing, and microencapsulation as well as emerging techniques such as atom transfer radical polymerization. At the end of each chapter are problems—including many that are new to this edition—to test the reader's grasp of core concepts as they advance through the text. There are also references leading to the primary literature for further investigation of individual topics. A classic in its field, this text enables students in chemistry, chemical engineering, materials science, and mechanical engineering to fully grasp and apply the fundamentals of polymeric materials, preparing them for more advanced coursework. *Basics of Polymer Chemistry* is of great interest to the chemistry audience. The basic properties of polymers, including diverse fundamental and applied aspects, are presented. This book constitutes a basis for understanding polymerization, and it presents a comprehensive overview of the scientific research of polymers. The chapters presented can be used as a reference for those interested in understanding the sustainable development in polymers. *Basics of Polymer Chemistry* provides a balanced coverage of the key developments in this field, and highlights recent and emerging technical achievements. The topics covered present a comprehensive overview of the subject area and are therefore of interest to professors and students. The recent developments in polymerization using catalysts, homo and copolymerization are presented, and it contains current efforts in designing new polymer architectures. Improved property performance attributes of the polymers by controlling their molecular-structural characteristics such as molecular weight distribution, comonomer type content distribution, and branching level are also discussed. Because of a lack of appreciation for his efforts in developing modern polymer science, the contributions of Hermann Staudinger were disregarded for decades. There have also been delays in recognizing the contributions of other pioneers in polymer science. Hence, it is gratifying to note that Professor Seymour chaired an American Chemical Society Symposium focusing on the contributions of these pioneers and that Kluwer Academic Publishers has published the proceedings of this important symposium. *H. Mark v DEDICATION* This book on *Pioneers in Polymer Science* is dedicated to Nobel Laureate Polymer Scientists Hermann Staudinger, Emil Fischer, Herman Mark, Paul J. Flory, Linus Pauling, Carl S. Marvel, M. Polanyi, Giulio Natta, Karl Ziegler, and Bruce Merrifield as well as to those pioneers such as J.C. Patrick, Robert Thomas, William Sparks, Maurice Huggins, Otto Bayer, Leo Baekeland, Anselm Payer, Roger Boyer, Waldo Semon, Robert Banks, J.P. Hogan, and other pioneers who, to a large degree, were responsible for the development of the world's second largest industry. **ACKNOWLEDGEMENT** The editor appreciates the contribution of co-authors Herman Mark, C.H. Fisher, and G. Alan Stahl who co chaired the Symposium on Pioneers in Polymer Science at the National Meeting of the American Chemical Society at Seattle, WA in 1984 and who contributed a chapter in this book. The editor is particularly grateful to Mischa Thomas who typed this manuscript. A well-rounded and articulate examination of polymer properties at the molecular level, *Polymer Chemistry* focuses on fundamental principles based on underlying chemical structures, polymer synthesis, characterization, and properties. It emphasizes the logical progression of concepts and provide mathematical tools as needed as well as fully derived problems for advanced calculations. The much-anticipated Third Edition expands and reorganizes material to better develop polymer chemistry concepts and update the remaining chapters. New examples and problems are also featured throughout. This revised edition: Integrates concepts from physics, biology, materials science, chemical engineering, and statistics as needed. Contains mathematical tools and step-by-step derivations for example problems Incorporates new theories and experiments using the latest tools and instrumentation and topics that appear prominently in current polymer science journals. The number of homework problems has been greatly increased, to over 350 in all. The worked examples and figures have been augmented. More examples of relevant synthetic chemistry have been introduced into Chapter 2 ("Step-Growth Polymers"). More details about atom-transfer radical polymerization and reversible addition/fragmentation chain-transfer polymerization have been added to Chapter 4 ("Controlled Polymerization"). Chapter 7 (renamed "Thermodynamics of Polymer Mixtures") now features a separate section on thermodynamics of polymer blends. Chapter 8 (still called "Light Scattering by Polymer Solutions") has been supplemented with an extensive introduction to small-angle neutron scattering. *Polymer Chemistry, Third Edition* offers a logical presentation of topics that can be scaled to meet the needs of introductory as well as more advanced courses in chemistry, materials science, polymer science, and chemical engineering. This comprehensive textbook describes the synthesis, characterization and technical and engineering applications of polymers. Offering a broad and balanced introduction to the basic concepts of macromolecular chemistry and to the synthesis and physical chemistry of polymers, it is the ideal text for graduate students and advanced Masters students starting out in polymer science. Building on the basic principles of organic chemistry and thermodynamics, it provides an easily understandable and highly accessible introduction to the topic. Step by step, readers will obtain a detailed and well-founded understanding of this vibrant and increasingly important subject area at the intersection between chemistry, physics, engineering and the life sciences. Following an approach different from many other textbooks in the field, the authors, with their varying backgrounds (both from academia and industry), offer a new perspective. Starting with a clear and didactic introduction, the book discusses basic terms and sizes and shapes of polymers and macromolecules. There then follow chapters dedicated to polymers in solutions, molar mass determination, and polymers in the solid state, incl. (partially) crystalline or amorphous polymers as well as their application as engineering materials. Based on this information, the authors explain the most important polymerization methods and techniques. Often neglected in other textbooks, there are

chapters on technical polymers, functional polymers, elastomers and liquid crystalline polymers, as well as polymers and the environment. An overview of current trends serves to generate further interest in present and future developments in the field. This book is the English translation of the successful German textbook "Polymere", which was awarded the Chemical Industry in Germany's 2015 literature Prize ("Literaturpreis des Fonds der Chemischen Industrie") for its innovative, novel approach, and its good accessibility and readability, while at the same time providing comprehensive coverage of the field of polymer science. This comprehensive textbook describes the synthesis, characterization and technical and engineering applications of polymers. Offering a broad and balanced introduction to the basic concepts of macromolecular chemistry and to the synthesis and physical chemistry of polymers, it is the ideal text for graduate students and advanced Masters students starting out in polymer science. Building on the basic principles of organic chemistry and thermodynamics, it provides an easily understandable and highly accessible introduction to the topic. Step by step, readers will obtain a detailed and well-founded understanding of this vibrant and increasingly important subject area at the intersection between chemistry, physics, engineering and the life sciences. Following an approach different from many other textbooks in the field, the authors, with their varying backgrounds (both from academia and industry), offer a new perspective. Starting with a clear and didactic introduction, the book discusses basic terms and sizes and shapes of polymers and macromolecules. There then follow chapters dedicated to polymers in solutions, molar mass determination, and polymers in the solid state, incl. (partially) crystalline or amorphous polymers as well as their application as engineering materials. Based on this information, the authors explain the most important polymerization methods and techniques. Often neglected in other textbooks, there are chapters on technical polymers, functional polymers, elastomers and liquid crystalline polymers, as well as polymers and the environment. An overview of current trends serves to generate further interest in present and future developments in the field. This book is the English translation of the successful German textbook "Polymere", which was awarded the Chemical Industry in Germany's 2015 literature Prize ("Literaturpreis des Fonds der Chemischen Industrie") for its innovative, novel approach, and its good accessibility and readability, while at the same time providing comprehensive coverage of the field of polymer science. In the ten years since the first edition appeared the renaissance in Free Radical Polymerization has continued to gain momentum. In this second revised edition, the authors critically evaluate the findings of the last decade, where necessary reinterpreting earlier work in the light of these ideas, and point to the areas where current and future research is being directed. The overall aim is to provide a framework for further extending our understanding of free radical polymerization and create a definable link between synthesis conditions and polymer structure and properties. The authors have updated all chapters, and added many new references and two new chapters to reflect the significant advances made in radical polymerization. One new chapter has been devoted to the area of living radical polymerization which is now responsible for a very substantial fraction of the papers in the field. In addition to offering polymers with unique compositions and properties not achievable with other methodologies, living radical polymerization has also been combined with other processes and mechanisms to give structures and architectures that were not previously thought possible. The developments are seen to have great application particularly in the emerging areas of electronics, biotechnology and nanotechnology. \* An excellent text suitable for graduates in polymer chemistry and a reference source for researchers and practitioners in radical polymerization \* Seven chapters revised and updated with eight years of new research \* A new chapter devoted to the growing field of living radical polymerization

**Publisher Description** Polymer Chemistry provides graduate and advanced undergraduate students with an up-to-date introduction to the chemistry of macromolecular substances, including their synthesis and the properties underlying their commercial importance. Significant new developments in polymer science over the past decade are covered, as are methods used for testing and characterising polymers. Industry and academia remain fascinated with the diverse properties and applications of polymers. However, most introductory books on this enormous and important field do not stress practical problem solving or include recent advances, which are critical for the modern polymer scientist-to-be. Updating the popular first edition of "the polymer book for the new millennium," *Introduction to Polymer Science and Chemistry: A Problem-Solving Approach, Second Edition* seamlessly integrates exploration of the fundamentals of polymer science and polymer chemistry. See What's New in the Second Edition: Chapter on living/controlled radical polymerization, using a unique problem-solving approach Chapter on polymer synthesis by "click" chemistry, using a unique problem-solving approach Relevant and practical work-out problems and case studies Examples of novel methods of synthesis of complex polymer molecules by exciting new techniques Figures and schematics of the novel synthetic pathways described in the new examples

**Author** Manas Chanda takes an innovative problem-solving approach in which the text presents worked-out problems or questions with answers at every step of the development of a new theory or concept, ensuring a better grasp of the subject and scope for self study. Containing 286 text-embedded solved problems and 277 end-of-chapter home-study problems (fully answered separately in a Solutions Manual), the book provides a comprehensive understanding of the subject. These features and more set this book apart from other currently available polymer chemistry texts. How can a scientist or engineer synthesize and utilize polymers to solve our daily problems? This introductory text, aimed at the advanced undergraduate or graduate student, provides future scientists and engineers with the fundamental knowledge of polymer design and synthesis to achieve specific properties required in everyday applications. In the first five chapters, this book discusses the properties and characterization of polymers, since designing a polymer initially requires us to understand the effects of chemical structure on physical and chemical characteristics. Six further chapters discuss the principles of polymerization reactions including step, radical chain, ionic chain, chain copolymerization, coordination and ring opening. Finally, material is also included on how commonly known polymers are synthesized in a laboratory and a factory. This book is suitable for a one semester course in polymer chemistry and does not demand prior knowledge of polymer science. This book deals with the organic chemistry of polymers which find technological use as adhesives, fibres, paints, plastics and rubbers. For the most part, only polymers which are of commercial significance are considered and the primary aim of the book is to relate theoretical aspects to industrial practice. The book is mainly intended for use by students in technical institutions and universities who are specializing in polymer science and by graduates who require an introduction to this field. Several excellent books have recently appeared dealing with the physical chemistry of polymers but the organic chemistry of polymers has not received so much attention. In recognition of this situation and because the two aspects of polymer chemistry are often taught separately, this book deals specifically with organic chemistry and topics of physical chemistry have been omitted. Also, in this way the book has been kept to a reasonable size. This is not to say that integration of the two areas of polymer science is undesirable; on the contrary, it is of the utmost importance that the inter-relationship should be appreciated. I wish to record my thanks to my colleagues with whom I have had many helpful discussions, particularly Mrs S. L. Radchenko. I also thank Miss E. Friesen for obtaining many books and articles on my behalf and Mr H. Harms for encouragement and assistance. I am also grateful to Mrs M. Stevens who skilfully prepared the manuscript. Department of Chemical and Metallurgical Technology, Ryerson Polytechnical Institute, K. J. S.

This book has been designed to appeal to both chemists working in, and new to, the area of polymer synthesis. It contains detailed instructions for the preparation of a wide-range of polymers by a wide variety of different techniques, and describes how this synthetic methodology can be applied to the development of new materials. It includes details of well-established techniques, e.g. chain-growth or step-growth processes together with more up-to-date examples using methods such as atom-transfer radical polymerisation. Less-well known procedures are also included, e.g. electrochemical synthesis of conducting polymers and the preparation of liquid crystalline elastomers with highly ordered structures. Other topics covered include general polymerisation methodology, controlled/'living' polymerisation methods, the formation of cyclic oligomers during step-growth polymerisation, the synthesis of conducting polymers based on heterocyclic compounds, dendrimers, the preparation of imprinted polymers and liquid crystalline polymers. The main bulk of the text is preceded by an introductory chapter detailing some of the techniques available to the scientist for the characterisation of polymers, both in terms of their chemical composition and in terms of their properties as materials. The book is intended not only for the specialist in polymer chemistry, but also for the organic chemist with little experience who requires a practical introduction to the field. Continuing the tradition of its previous editions, the third edition of *Introduction to Polymer Chemistry* provides a well-rounded presentation of the principles and applications of natural, synthetic, inorganic, and organic polymers. With an emphasis on the environment and green chemistry and materials, this third edition offers detailed coverage of natural and synthetic giant molecules, inorganic and organic polymers, biomacromolecules, elastomers, adhesives, coatings, fibers, plastics, blends, caulks, composites, and ceramics. Using simple fundamentals, the book demonstrates how the

basic principles of one polymer group can be applied to all of the other groups. It covers reactivities, synthesis and polymerization reactions, techniques for characterization and analysis, energy absorption and thermal conductivity, physical and optical properties, and practical applications. This edition addresses environmental concerns and green polymeric materials, including biodegradable polymers and microorganisms for synthesizing materials. Case studies woven within the text illustrate various developments and the societal and scientific contexts in which these changes occurred. Now including new material on environmental science, Introduction to Polymer Chemistry, Third Edition remains the premier book for understanding the behavior of polymers. Building on undergraduate work in foundational courses, the text fulfills the American Chemical Society Committee on Professional Training (ACS CPT) in-depth course requirement.

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