

Mechanics Of Solid Polymers Theory And Computational Modeling

The second edition of Principles of Polymer Engineering brings up-to-date coverage for undergraduates studying materials and polymer science. The opening chapters show why plastics and rubbers have such distinctive properties and how they are affected by temperature, strain rate, and other factors. The rest of the book concentrates on how these properties can be exploited to produce functional components within the constraints placed on them. The main changes for the second edition are a new chapter on environmental issues and substantially rewritten sections on yield and fracture and forming. To request a copy of the Solutions Manual, visit: <http://global.oup.com/uk/academic/physics/admin/solutions>

Elementary Materials Science covers the subject of materials science with few equations; it is intended primarily for students with limited science backgrounds who are interested in materials. The book also will be useful for non-technical professionals in the materials industry.

This book discusses polymers from a mechanical engineering perspective, treating stresses and deformations in polymeric structural components.

Multiphase polymeric systems include a wide range of materials such as composites, blends, alloys, gels, and interpenetrating polymer networks (IPNs). A one-stop reference on multiphase polymer systems, this book fully covers the preparation, properties, and applications of advanced multiphase systems from macro to nano scales. Edited by well-respected academics in the field of multiphase polymer systems, the book includes contributions from leading international experts. An essential resource for plastic and rubber technologists, filler specialists and researchers in fields studying thermal and electrical properties.

Written in the perspective of an experimental chemist, this book puts together some fundamentals from chemistry, solid state physics and quantum chemistry, to help with understanding and predicting the electronic and optical properties of organic semiconductors, both polymers and small molecules. The text is intended to assist graduate students and researchers in the field of organic electronics to use theory to design more efficient materials for organic electronic devices such as organic solar cells, light emitting diodes and field effect transistors. After addressing some basic topics in solid state physics, a comprehensive introduction to molecular orbitals and band theory leads to a description of computational methods based on Hartree-Fock and density functional theory (DFT), for predicting geometry conformations, frontier levels and energy band structures. Topological defects and transport and optical properties are then addressed, and one of the most commonly used transparent conducting polymers, PEDOT:PSS, is described in some detail as a case study.

A physical, mechanism-based presentation of the plasticity and fracture of polymers, covering industrial scale applications through to nanoscale biofluidic devices.

This book deals with all aspects of advanced composite materials; what they are, where they are used, how they are made, their properties, how they are designed and analyzed, and how they perform in-service. It covers both continuous and discontinuous fiber composites fabricated from polymer, metal, and ceramic matrices, with an emphasis on continuous fiber polymer matrix composites.

Providing an updated and comprehensive account of the properties of solid polymers, the book covers all aspects of mechanical behaviour. This includes finite elastic behavior, linear viscoelasticity and mechanical relaxations, mechanical anisotropy, non-linear viscoelasticity, yield behavior and fracture. New to this edition is coverage of polymer nanocomposites, and molecular interpretations of yield, e.g. Bowden, Young, and Argon. The book begins by focusing on the structure of polymers, including their chemical composition and physical structure. It goes on to discuss the mechanical properties and behaviour of polymers, the statistical molecular theories of the rubber-like state and describes aspects of linear viscoelastic behaviour, its measurement, and experimental studies. Later chapters cover composites and experimental behaviour, relaxation transitions, stress and yielding. The book concludes with a discussion of breaking phenomena.

Rheology of Polymer Blends and Nanocomposites: Theory, Modelling and Applications focuses on rheology in polymer nanocomposites. It provides readers with a solid grounding in the fundamentals of rheology, with an emphasis on recent advancements. Chapters explore potential future applications for nanocomposites and polymer blends, giving readers a thorough understanding of the specific features derived from rheology as a tool for the study of polymer blends and nanocomposites. This book is ideal for industrial and academic researchers in the field of polymer blends and nanocomposites, but is also a great resource for anyone who wants to learn about the applications of rheology. Sets out the principles of rheology as it is applied to polymer blends and nanocomposites Demonstrates how rheological techniques are best applied to different classes of nanocomposites Assesses the opportunities and major challenges of rheological approaches to polymer blends and nanocomposites

Polymers are used in everything from nylon stockings to commercial aircraft to artificial heart valves, and they have a key role in addressing international competitiveness and other national issues. Polymer Science and Engineering explores the universe of polymers, describing their properties and wide-ranging potential, and presents the state of the science, with a hard look at downward trends in research support. Leading experts offer findings, recommendations, and research directions. Lively vignettes provide snapshots of polymers in everyday applications. The volume includes an overview of the use of polymers in such fields as medicine and biotechnology, information and communication, housing and construction, energy and transportation, national defense, and environmental protection. The committee looks at the various classes of polymers--plastics, fibers, composites, and other materials, as well as polymers used as membranes and coatings--and how their composition and specific methods of processing result in unparalleled usefulness. The reader can also learn the science behind the technology, including efforts to model polymer synthesis after nature's methods, and breakthroughs in characterizing polymer properties needed for twenty-first-century applications. This informative volume will be important to chemists, engineers, materials scientists, researchers, industrialists, and policymakers interested in the role of polymers, as well as to science and engineering educators and students.

An introduction to lattice models of polymers - an area of intense research activity - for graduate students and researchers.

NMR spectroscopy is the most valuable and versatile analytical tool in chemistry. While excellent monographs exist on high-resolution NMR in liquids and solids, this is the first book to address multidimensional solid-state NMR. Multidimensional techniques enable researchers to obtain detailed information about the structure, dynamics, orientation, and phase separation of solids, which provides the basis of a better understanding of materials properties on the molecular level. Dramatic progress--much of it pioneered by the authors--has been achieved in this area, especially in synthetic polymers. Solid-state NMR now favorably competes with well-established techniques, such as light, x-ray, or neutron scattering, electron microscopy, and dielectric and mechanical relaxation. The application of multidimensional solid-state NMR inevitably involves use of concepts from different fields of science. This book also provides the first comprehensive treatment of both the new experimental techniques and the theoretical concepts needed in more complex data analysis. The text addresses spectroscopists and polymer scientists by treating the subject on different levels; descriptive, technical, and mathematical approaches are used when appropriate. It presents an overview of new developments with numerous experimental examples and illustrations, which will appeal to readers interested in both the information content as well as the potential of solid-state NMR. The book also contains many previously unpublished details that will be appreciated by those who want to perform the experiments. The techniques described are applicable not only to the study of synthetic polymers but to numerous problems in solid-state physics, chemistry, materials science, and biophysics. Key Features * Presents original theories

and new perspectives on scattering techniques * Provides a systematic treatment of the whole subject * Gives readers access to previously unpublished material * Includes extensive illustrations
Modern computer simulations make stress analysis easy. As they continue to replace classical mathematical methods of analysis, these software programs require users to have a solid understanding of the fundamental principles on which they are based. Develop Intuitive Ability to Identify and Avoid Physically Meaningless Predictions Applied Mechanics o
Mechanics of Solid Polymers Theory and Computational Modeling William Andrew

Recent investigations into blast-resistant properties of polyureas and other multi-phase polymeric elastomers indicate that they can dissipate broad bands of frequencies such as those encountered in blast events. In this unique book, *Elastomeric Polymers with High Rate Sensitivity*, Dr. Roshdy Barsoum and expert contributors bring together the cutting-edge testing methodologies, material properties, and critical design data for engineers seeking to deploy this technology. Where conventional methods of resisting blast, shockwave, and penetration are expensive, time-consuming and impractical, high-strain rate elastomeric polymers (HSREP) can be cheaper, quicker, and more easily applied to new and old materials alike. This book aids both military and civilian engineers in a range of applications, from buildings and tunnels to lightweight armor, ships, and aircraft. The book features constitutive models for software developers designing with these advanced polymers, as well as a discussion of the mechanisms of interaction between high-strain rate polymers and other materials. It also thoroughly covers HSREP engineering methods to achieve other unique properties, such as fireproofing. Material properties and design data included to enable engineers to successfully deploy this technology Cheaper, quicker, and more easily implemented than traditional methods of increasing blast and ballistic performance A how-to guide to the engineering of high strain rate elastomeric polymers to achieve other useful properties, such as fireproofing

Over recent years there has been a tremendous upsurge in interest in the fracture behaviour of polymers. One reason for this is the increasing use of polymers in structural engineering applications, since in such circumstances it is essential to have as complete an understanding as possible of the polymer's fracture behaviour. This book is designed to meet the requirements of those who need to be informed of the latest developments in the field of polymer fracture. It is written particularly for research workers but it should also prove invaluable for advanced students taking final-year undergraduate or postgraduate courses. The main emphasis is upon the use of fracture mechanics in the study of polymer fracture but this approach is then developed to cover the micromechanisms of the fracture process. Particular prominence is given to the relationship between structure, mechanical properties and the mechanics and mechanisms of fracture. The first chapter is a brief introduction which has several aims. One is to introduce polymers to the reader who does not have a strong background in the subject and another is to provide background material that will be used at later stages. The book is then split into two main parts: the first deals with the mechanics and mechanisms whilst the second is concerned with materials. In Part I phenomena such as molecular fracture, fracture mechanics, shear yielding and crazing are covered from a general viewpoint.

A concise, self-contained introduction to solid polymers, the mechanics of their behavior and molecular and structural interpretations. This updated edition provides extended coverage of recent developments in rubber elasticity, relaxation transitions, non-linear viscoelastic behavior, anisotropic mechanical behavior, yield behavior of polymers, breaking phenomena, and other fields.

This book provides a pedagogical introduction to the theoretical and computer simulation techniques that are useful in the design of polymer formulations including personal care products, multiphase plastic materials, processed foods, and colloidal and nanoparticle dispersions. The book serves to unify previous work in a common language and provides a balanced treatment of analytical theory and numerical techniques, including an introduction to the exciting new field of field-theoretic polymer simulations - the direct numerical simulation of field theory models of meso-structured polymer melts, solutions, and dispersions.

In *Carbon Fiber Composites*, the reader is introduced to a wide range of carbon fiber composites, including polymer-matrix, metal matrix, carbon-matrix, ceramic-matrix and hybrid composites. The subject is examined in a tutorial fashion, so that no prior knowledge of the field is required. In contrast to other books on composites, this book emphasizes materials rather than mechanics, as the prominence of composite materials has resulted from their increased presence in applications other than structure. Provides up-to-date information on the entire spectrum of carbon fiber composites Emphasizes processing as the foundation of composite materials development Addresses the processing, properties and applications of each type of material systematically

This volume explores the mechanics of the behaviour of solid polymers, discussing molecular and structural interpretations and emphasizing the physical rather than the engineering approach. Readers are provided with a set of elementary problems and their solutions.

This is a textbook for courses in civil and mechanical engineering that are commonly called Strength of Materials or Mechanics of Materials. The intent of this book is to provide a background in the mechanics of solids for students of mechanical engineering, while limiting the information on why materials behave as they do. It is assumed that the students have already had courses covering materials science and basic statics. Much of the material is drawn from another book by the author, *Mechanical Behavior of Materials*. To make the text suitable for mechanical engineers, the chapters on slip, dislocations, twinning, residual stresses, and hardening mechanisms have been eliminated and the treatment of ductility viscoelasticity, creep, ceramics, and polymers has been simplified.

Most of the shaping in the manufacture of polymeric objects is carried out in the melt state, as it is a substantial part of the physical property development. Melt processing involves an interplay between fluid mechanics and heat transfer in rheologically complex liquids, and taken as a whole it is a nice example of the importance of coupled transport processes. This book is on the underlying foundations of polymer melt processing, which can be derived from relatively straightforward ideas in fluid mechanics and heat transfer; the level is that of an advanced undergraduate or beginning graduate course, and the material can serve as the text for a course in polymer processing or for a second course in transport processes.

A new edition explaining the underlying science and applications of liquid crystalline polymers.

Composite materials have been representing most significant breakthroughs in various industrial applications, particularly in aerospace structures, during the past thirty five years. The primary goal of *Advanced Mechanics of Composite Materials* is the combined presentation of advanced mechanics, manufacturing technology, and analysis of composite materials. This approach lets the engineer take into account the essential mechanical properties of the material itself and special features of practical implementation, including manufacturing technology, experimental results, and design characteristics. Giving complete coverage of the topic: from basics and fundamentals to the advanced analysis including practical design and engineering applications. At

the same time including a detailed and comprehensive coverage of the contemporary theoretical models at the micro- and macro- levels of material structure, practical methods and approaches, experimental results, and optimisation of composite material properties and component performance. The authors present the results of more than 30 year practical experience in the field of design and analysis of composite materials and structures. * Eight chapters progressively covering all structural levels of composite materials from their components through elementary plies and layers to laminates * Detailed presentation of advanced mechanics of composite materials * Emphasis on nonlinear material models (elasticity, plasticity, creep) and structural nonlinearity

This book provides a unified mechanics and materials perspective on polymers: both the mathematics of viscoelasticity theory as well as the physical mechanisms behind polymer deformation processes. Introductory material on fundamental mechanics is included to provide a continuous baseline for readers from all disciplines. Introductory material on the chemical and molecular basis of polymers is also included, which is essential to the understanding of the thermomechanical response. This self-contained text covers the viscoelastic characterization of polymers including constitutive modeling, experimental methods, thermal response, and stress and failure analysis. Example problems are provided within the text as well as at the end of each chapter. New to this edition: · One new chapter on the use of nano-material inclusions for structural polymer applications and applications such as fiber-reinforced polymers and adhesively bonded structures · Brings up-to-date polymer production and sales data and equipment and procedures for evaluating polymer characterization and classification · The work serves as a comprehensive reference for advanced seniors seeking graduate level courses, first and second year graduate students, and practicing engineers

Provides a comprehensive introduction to the mechanical behaviour of solid polymers. Extensively revised and updated throughout, the second edition now includes new material on mechanical relaxations and anisotropy, composites modelling, non-linear viscoelasticity, yield behaviour and fracture of tough polymers. The accessible approach of the book has been retained with each chapter designed to be self contained and the theory and applications of the subject carefully introduced where appropriate. The latest developments in the field are included alongside worked examples, mathematical appendices and an extensive reference. Fully revised and updated throughout to include all the latest developments in the field Worked examples at the end of the chapter An invaluable resource for students of materials science, chemistry, physics or engineering studying polymer science

Viscoelastic behavior reflects the combined viscous and elastic responses, under mechanical stress, of materials which are intermediate between liquids and solids in character. Polymers the basic materials of the rubber and plastic industries and important to the textile, petroleum, automobile, paper, and pharmaceutical industries as well exhibit viscoelasticity to a pronounced degree. Their viscoelastic properties determine the mechanical performance of the final products of these industries, and also the success of processing methods at intermediate stages of production. Viscoelastic Properties of Polymers examines, in detail, the effects of the many variables on which the basic viscoelastic properties depend. These include temperature, pressure, and time; polymer chemical composition, molecular weight and weight distribution, branching and crystallinity; dilution with solvents or plasticizers; and mixture with other materials to form composite systems. With guidance by molecular theory, the dependence of viscoelastic properties on these variables can be simplified by introducing certain ancillary concepts such as the fractional free volume, the monomeric friction coefficient, and the spacing between entanglement loci, to provide a qualitative understanding and in many cases a quantitative prediction of how to achieve desired results. The phenomenological theory of viscoelasticity which permits interrelation of the results of different types of experiments is presented first, with many useful approximation procedures for calculations given. A wide variety of experimental methods is then described, with critical evaluation of their applicability to polymeric materials of different consistencies and in different regions of the time scale (or, for oscillating deformations, the frequency scale). A review of the present state of molecular theory follows, so that viscoelasticity can be related to the motions of flexible polymer molecules and their entanglements and network junctions. The dependence of viscoelastic properties on temperature and pressure, and its descriptions using reduced variables, are discussed in detail. Several chapters are then devoted to the dependence of viscoelastic properties on chemical composition, molecular weight, presence of diluents, and other features, for several characteristic classes of polymer materials. Finally, a few examples are given to illustrate the many potential applications of these principles to practical problems in the processing and use of rubbers, plastics, and fibers, and in the control of vibration and noise. The third edition has been brought up to date to reflect the important developments, in a decade of exceptionally active research, which have led to a wider use of polymers, and a wider recognition of the importance and range of application of viscoelastic properties. Additional data have been incorporated, and the book's chapters on dilute solutions, theory of undiluted polymers, plateau and terminal zones, cross-linked polymers, and concentrated solutions have been extensively rewritten to take into account new theories and new experimental results. Technical managers and research workers in the wide range of industries in which polymers play an important role will find that the book provides basic information for practical applications, and graduate students in chemistry and engineering will find, in its illustrations with real data and real numbers, an accessible introduction to the principles of viscoelasticity.

Very few polymer mechanics problems are solved with only pen and paper today, and virtually all academic research and industrial work relies heavily on finite element simulations and specialized computer software. Introducing and demonstrating the utility of computational tools and simulations, Mechanics of Solid Polymers provides a modern view of how solid polymers behave, how they can be experimentally characterized, and how to predict their behavior in different load environments. Reflecting the significant progress made in the understanding of polymer behaviour over the last two decades, this book will discuss recent developments and compare them to classical theories. The book shows how best to make use of commercially available finite element software to solve polymer mechanics problems, introducing readers to the current state of the art in predicting failure using a combination of experiment and computational techniques. Case studies and example Matlab code are also included. As industry and academia are increasingly reliant on advanced computational mechanics software to implement sophisticated constitutive models – and authoritative information is hard to find in one place - this book provides engineers with what they need to know to make best use of the technology available. Helps professionals deploy the latest experimental polymer testing methods to assess suitability for applications Discusses material models for different polymer types Shows how to best make use of available finite element software to model polymer behaviour, and includes case studies and example code to help engineers and researchers apply it to their work

Understanding of polymer interactions is important for effective processing of plastics and their blends, mixing with nanoparticles, and understanding of their mechanical and physical (e.g., electrical) properties. This book describes a new physics of interactions in polymers that challenges existing theories, and explains the concept of entanglement in a very different way. Rheology is formulated with different parameters defining the physics of dual-phase and cross-dual-phase. The rubbery behavior of thermoplastics is explained quite differently to conventional theory. Rheo-fluidification experiments which are applicable to industry (injection molding, extrusion, sheet forming, etc.) are described and analyzed, including molding under conditions of reduced viscosity (up to several hundred percent). The application of this theory to industry has already been proven by a number of successful derived inventions.

Applied Mechanics of Polymers: Properties, Processing, and Behavior provides readers with an overview of the properties, mechanical behaviors and modeling techniques for accurately predicting the

behaviors of polymeric materials. The book starts with an introduction to polymers, covering their history, chemistry, physics, and various types and applications. In addition, it covers the general properties of polymers and the common processing and manufacturing processes involved with them. Subsequent chapters delve into specific mechanical behaviors of polymers such as linear elasticity, hyperelasticity, creep, viscoelasticity, failure, and fracture. The book concludes with chapters discussing electroactive polymers, hydrogels, and the mechanical characterization of polymers. This is a useful reference text that will benefit graduate students, postdocs, researchers, and engineers in the mechanics of materials, polymer science, mechanical engineering and material science. Provides examples of real-world applications that demonstrate the use of models in designing polymer-based components Includes access to a companion site from where readers can download FEA and MATLAB code, FEA simulation files, videos and other supplemental material Features end-of-chapter summaries with design and analysis guidelines, practice problem sets based on real-life situations, and both analytical and computational examples to bridge academic and industrial applications

A balanced mechanics-materials approach and coverage of the latest developments in biomaterials and electronic materials, the new edition of this popular text is the most thorough and modern book available for upper-level undergraduate courses on the mechanical behavior of materials. To ensure that the student gains a thorough understanding the authors present the fundamental mechanisms that operate at micro- and nano-meter level across a wide-range of materials, in a way that is mathematically simple and requires no extensive knowledge of materials. This integrated approach provides a conceptual presentation that shows how the microstructure of a material controls its mechanical behavior, and this is reinforced through extensive use of micrographs and illustrations. New worked examples and exercises help the student test their understanding. Further resources for this title, including lecture slides of select illustrations and solutions for exercises, are available online at www.cambridge.org/97800521866758.

A mechanics perspective on the mathematics of viscoelasticity and a materials view of the physical mechanisms behind the polymer deformation processes, are provided by this book. The book fills a critical niche. Clearly written and well-organized, the volume includes an introduction to and mathematical description of the basic materials science of polymers, time-temperature-frequency dependence, and unique deformation mechanisms of polymers.

Advanced Mechanics of Composite Materials and Structural Elements analyzes contemporary theoretical models at the micro- and macro levels of material structure. Its coverage of practical methods and approaches, experimental results, and optimization of composite material properties and structural component performance can be put to practical use by researchers and engineers. The third edition of the book consists of twelve chapters progressively covering all structural levels of composite materials from their constituents through elementary plies and layers to laminates and laminated composite structural elements. All-new coverage of beams, plates and shells adds significant currency to researchers. Composite materials have been the basis of many significant breakthroughs in industrial applications, particularly in aerospace structures, over the past forty years. Their high strength-to-weight and stiffness-to-weight ratios are the main material characteristics that attract the attention of the structural and design engineers. Advanced Mechanics of Composite Materials and Structural Elements helps ensure that researchers and engineers can continue to innovate in this vital field. Detailed physical and mathematical coverage of complex mechanics and analysis required in actual applications – not just standard homogeneous isotropic materials Environmental and manufacturing discussions enable practical implementation within manufacturing technology, experimental results, and design specifications. Discusses material behavior impacts in-depth such as nonlinear elasticity, plasticity, creep, structural nonlinearity enabling research and application of the special problems of material micro- and macro-mechanics

Poly mer Interface and Adhesion provides the critical basis for further advancement in thisfield. Combining the principles of interfacial science, rheology, stress analysis, and fracturemechanics, the book teaches a new approach to the analysis of long standing problemssuch as: how is the interface formed; what are its physical and mechanical properties;and how does the interface modify the stress field and fracture strength of the material.The book offers many outstanding features, including extensive listings of pertinent references,exhaustive tabulations of the interfacial properties of polymers, critical reviews ofthe many conflicting theories, and complete discussions of coupling agents, adhesion promotion,and surface modifications. Emphasis is placed on physical concepts and mechanisms,using clear, understandable mathematics.Polymer Interface and Adhesion promotes a more thorough understanding of the physical,mechanical, and adhesive properties of multiphase, polymer systems. Polymer scientistsand engineers, surface chemists, materials scientists, rheologists, as well as chemical andmechanical engineers interested in the research, development or industrial applications ofpolymers, plastics, fibers, coatings, adhesives, and composites need this important newsorce book.

As a reference book, the Springer Handbook provides a comprehensive exposition of the techniques and tools of experimental mechanics. An informative introduction to each topic is provided, which advises the reader on suitable techniques for practical applications. New topics include biological materials, MEMS and NEMS, nanoindentation, digital photomechanics, photoacoustic characterization, and atomic force microscopy in experimental solid mechanics. Written and compiled by internationally renowned experts in the field, this book is a timely, updated reference for both practitioners and researchers in science and engineering.

Continuum Mechanics of Solids is an introductory text for graduate students in the many branches of engineering, covering the basics of kinematics, equilibrium, and material response. As an introductory book, most of the emphasis is upon the kinematically linear theories of elasticity, plasticity, and viscoelasticity, with two additional chapters devoted to topics in finite elasticity. Further chapters cover topics in fracture and fatigue and coupled field problems, such as thermoelasticity, chemoelasticity, poroelasticity, and piezoelectricity. There is ample material for a two semester course, or by selecting only topics of interest for a one-semester offering. The text includes numerous examples to aid the student. A companion text with over 180 fully worked problems is also available.

Surface Phenomena in the Structural and Mechanical Behaviour of Solid Polymers explores the role of various surface phenomena in the structural and mechanical behaviour of

amorphous and semicrystalline polymers. This book: Discusses the development of the interfacial surface in the deformation of polymers Examines the healing of interfacial surfaces in polymers Inspects the structure and properties of polymers in thin films and surface layers Evaluates the mechanism of inelastic deformation in glassy amorphous polymers Investigates strain softening and the phenomena taking place upon deformation of polymers in active liquid media Covers the Reh binder effect, or the adsorption reduction of the strength of solids Describes the properties of polymers in environmental or solvent crazing Analyses the interaction of the highly developed surface of crazed polymers with diverse low- and high-molecular mass components Addresses the instability and self-organisation of surface layers in polymers and diverse polymer systems Presents theoretical speculations concerning the structurally mechanical behaviour of 'a rigid coating on a soft substratum' (RCSS) systems Assesses the stress-strain properties of the thin surface layers of polymers and the nanometric coatings deposited on their surfaces Highlights the efficacy of the approaches developed for RCSS systems for the analysis and description of natural phenomena Details the applied aspects of surface phenomena in the structurally mechanical behaviour of polymers Thus, Surface Phenomena in the Structural and Mechanical Behaviour of Solid Polymers provides a useful framework for the development of new and innovative polymer-based materials. Over the past twenty years our understanding of polymer solutions has undergone a dramatic evolution. New methods and concepts have extended the frontier of the theory from dilute solutions in which polymers move independently of each other, to concentrated solutions where many polymers entangle with each other. This book provides a comprehensive account of the modern theory for the dynamical properties of polymer solutions. This includes viscoelasticity, diffusion, dynamic light scattering and flow and electric birefringence. Nonlinear viscoelasticity is discussed in detail on the basis of molecular dynamical models. The book fills a gap between classical theory and modern developments and constructs a consistent picture for the dynamics of polymer solutions over the entire concentration range.

A practical reference for all plastics engineers who are seeking to answer a question, solve a problem, reduce a cost, improve a design or fabrication process, or even venture into a new market. Applied Plastics Engineering Handbook covers both polymer basics – helpful to bring readers quickly up to speed if they are not familiar with a particular area of plastics processing – and recent developments – enabling practitioners to discover which options best fit their requirements. Each chapter is an authoritative source of practical advice for engineers, providing authoritative guidance from experts that will lead to cost savings and process improvements. Throughout the book, the focus is on the engineering aspects of producing and using plastics. The properties of plastics are explained along with techniques for testing, measuring, enhancing and analyzing them. Practical introductions to both core topics and new developments make this work equally valuable for newly qualified plastics engineers seeking the practical rules-of-thumb they don't teach you in school, and experienced practitioners evaluating new technologies or getting up to speed on a new field The depth and detail of the coverage of new developments enables engineers and managers to gain knowledge of, and evaluate, new technologies and materials in key growth areas such as biomaterials and nanotechnology This highly practical handbook is set apart from other references in the field, being written by engineers for an audience of engineers and providing a wealth of real-world examples, best practice guidance and rules-of-thumb

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