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Computer Aided Design of Polymers and Composites Principles of Polymer Design and Synthesis *Engineering Design with Polymers and Composites, Second Edition* Engineering Design with Polymers and Composites Design and Synthesis of Conjugated Polymers **Shape-Memory Polymer Device Design** *Polymer Processing* **Engineering Design with Polymers and Composites** Design and Fabrication of Large Polymer Constructions in Space **Designing Safer Polymers** Principles of Polymer Design and Synthesis *Coordination Polymers* **Mechanical Performance and Design in Polymers** Structural Design of Polymer Composites **Porous Polymers** High Modulus Polymers **Structural Design of Polymer Composites** Functional Polymers *Solutions Manual -- Engineering Design with Polymers and Composites* **Engineering Design with Polymers and Composites** **Foundations in Polymer Clay Design** **Design and Applications of Nanostructured Polymer Blends and Nanocomposite Systems** Multifunctional Hybrid Materials Based on Polymers **Polymer-Based Composites** **Design and Characterization of Biomimetic Polymers** **Conductive Polymers and Plastics** **Responsive Polymer Materials** **Polymer Clay Surface Design Recipes** **Computational Materials Discovery** Applications of Polymers and Plastics in Medical Devices **Lightweight Polymer Composite Structures** **Macromolecular Engineering** Bioresponsive Polymers Polymer Engineering Principles Printing on Polymers **Polymer Products** **Mechanics of Solid Polymers** Metal-Polymer Systems Structural Design of Polymer Composites **Nanostructured Polymer Blends**

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The increasing use of composite materials over conventional materials has been a continual trend for over a decade. While the fundamental understanding of fiber reinforcement has not changed, many new material advancements have occurred, especially in manufacturing methods, and there is an ever-growing number of composite material applications across various industries. **Polymer-Based Composites: Design, Manufacturing, and Applications** presents the concepts and methods involved in the development of various fiber-reinforced composite materials. Features: Offers a comprehensive view of materials, mechanics, processing, design, and applications Bridges the gap between research, manufacturing science, and analysis and design Discusses composite materials composed of continuous synthetic fibers and matrices for use in engineering structures Presents codes and standards related to fiber-reinforced polymer composites Includes case studies and examples based on industrial, automotive, aerospace, and household applications This book is a valuable resource for advanced students, researchers, and industry personnel to understand recent advances in the field and achieve practical results in the development, manufacture, and application of advanced composite materials. There are

many books available on polymer chemistry, properties, and processing, but they do not focus on the practicalities of selecting and using them correctly in the design of structures. Engineering students require an understanding of polymers and composites as well as viscoelasticity, adhesion, damping applications, and tribology in order to successfully integrate these materials into their designs. Based on more than twenty years of classroom experience, *Engineering Design with Polymers and Composites* is the first textbook to unite these topics in a single source. The authors take a bottom-up functional approach rather than a top-down analytical approach to design. This unique perspective enables students to select the proper materials for the application rather than force the design to suit the materials. The text begins with an introduction to polymers and composites, including historical background. Detailed coverage of mechanical properties, viscoelastic behavior of polymers, composite materials, creep and fatigue failure, impact, and related properties follows. Discussion then turns to selection of materials, design applications of polymers, polymer processing, adhesion, tribology, and damping and isolation. Abundant examples, homework problems, tables, and illustrations reinforce the concepts. Accompanied by a CD-ROM containing materials databases, examples in Excel, and a laminate analysis program, *Engineering Design with Polymers and Composites* builds a strong background in the underlying concepts necessary for engineering students to successfully incorporate polymers and composites into their designs. Multifunctional hybrid materials based on polymers have already displayed excellent commitment in addressing and presenting solutions to existing demands in priority areas such as the environment, human health, and energy. These hybrid materials can lead to unique superior multifunction materials with a broad range of envisaged applications. However, their design, performance, and practical applications are still challenging. Thus, it is highly advantageous to provide a breakthrough in state-of-the-art manufacturing and scale-up technology to design and synthesize advanced multifunctional hybrid materials based on polymers with improved performance. The main objective of this interdisciplinary book is to bring together, at an international level, high-quality elegant collection of reviews and original research articles dealing with polymeric hybrid materials within different areas such as the following: - Biomaterials chemistry, physics, engineering, and processing; - Polymer chemistry, physics and engineering; - Organic chemistry; - Composites science; - Colloidal chemistry and physics; - Porous nanomaterials science; - Energy storage; and - Automotive and aerospace manufacturing. Independent, practical guidance on the structural design of polymer composites is provided for the first time in this book. Structural designers familiar with design of conventional structural materials such as steel and concrete will be able to use it to design a broad range of polymeric composites for structural applications, using glass fibre reinforced plastic materials, components, connections and assemblies. A comprehensive overview of different porous polymer systems focusing on structure design, synthesis method and properties. 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. Fundamental concepts coupled with practical, step-by-step guidance With its emphasis on core principles, this text equips readers with the skills and knowledge to design the many processes needed to safely and successfully manufacture thermoplastic parts. The first half of the text sets forth the

general theory and concepts underlying polymer processing, such as the viscoelastic response of polymeric fluids and diffusion and mass transfer. Next, the text explores specific practical aspects of polymer processing, including mixing, extrusion dies, and post-die processing. By addressing a broad range of design issues and methods, the authors demonstrate how to solve most common processing problems. This Second Edition of the highly acclaimed Polymer Processing has been thoroughly updated to reflect current polymer processing issues and practices. New areas of coverage include: Micro-injection molding to produce objects weighing a fraction of a gram, such as miniature gears and biomedical devices New chapter dedicated to the recycling of thermoplastics and the processing of renewable polymers Life-cycle assessment, a systematic method for determining whether recycling is appropriate and which form of recycling is optimal Rheology of polymers containing fibers Chapters feature problem sets, enabling readers to assess and reinforce their knowledge as they progress through the text. There are also special design problems throughout the text that reflect real-world polymer processing issues. A companion website features numerical subroutines as well as guidance for using MATLAB®, IMSL®, and Excel to solve the sample problems from the text. By providing both underlying theory and practical step-by-step guidance, Polymer Processing is recommended for students in chemical, mechanical, materials, and polymer engineering. The result of decades of research by a pioneer in the field, this is the first book to deal exclusively with achieving high-performance metal-polymer composites by chemical bonding. Covering both the academic and practical aspects, the author focuses on the chemistry of interfaces between metals and polymers with a particular emphasis on the chemical bonding between the different materials. He elucidates the various approaches to obtaining a stable interface, including, but not limited to, thermodynamically driven redox reactions, bond protection to prevent hydrolysis, the introduction of barrier layers, and stabilization by spacer molecules. Throughout, chemical bonding is promoted as a simple and economically viable alternative to adhesion based on reversible weak physical interaction. Consequently, the text equips readers with the practical tools necessary for designing high-strength metal-polymer composites with such desired properties as resilience, flexibility, rigidity or degradation resistance. Macromolecular Engineering: Design, Synthesis and Application of Polymers explores the role of macromolecular engineering in the development of polymer systems with engineered structures that offer the desired combination of properties for advanced applications. This book is organized into sections covering theory and principles, science and technology, architectures and technologies, and applications, with an emphasis on the latest advances in techniques, materials, properties, and end uses – and including recently commercialized, or soon to be commercialized, designed polymer systems. The chapters are contributed by a group of leading figures who are actively researching in the field. This is an invaluable resource for researchers and scientists interested in polymer synthesis and design, across the fields of polymer chemistry, polymer science, plastics engineering, and materials science and engineering. In industry, this book supports engineers, R&D, and scientists working on polymer design for application areas such as biomedical and healthcare, automotive and aerospace, construction and consumer goods. Presents the theory, principles, architectures, technologies, and latest advances in macromolecular engineering for polymer design and synthesis Explains polymer design for cutting-edge applications areas, including coatings, automotive, industrial, household and medical uses Approaches several novel materials, such as polyisobutylene (PIB), polyamide-based polyurethanes, and aliphatic polyesters Engineering Design with Polymers and Composites, Second Edition continues to provide one of the only textbooks on the analysis and design of mechanical components made from polymer materials. It explains how to create polymer materials to meet design specifications. After tracing the history of polymers and composites, the text describes modern design This first systematic compilation of synthesis methods for different classes of polymers describes well-tested and reproducible procedures, thus saving time, money and chemicals. Each chapter presents the latest method for a specific class of conjugated polymers with a particular emphasis on the design aspects for organo-electronic applications. In this concise and practically oriented manner, readers are introduced to the strategies of influencing and controlling the polymer properties with respect to their use in the desired device. This style of presentation quickly helps researchers in their daily lab work and prevents them from reinventing the wheel over and over again. "This book will teach you how to create a wonderful array of unique surface designs, each made by combining day with other media such as inks, paints, and powders, and other tools such as stamps, brushes, stencils, brayers, and wire. Starting with a comprehensive overview on working with day, the book then offers more than 100 surface recipes and variations with complete details about how the effect was achieved."-- Back cover. This book is a collection of papers by individuals in industry and academia on research and application development of conductive polymers and plastics. Conductive plastics are positioned to play an increasingly important role in affairs of mankind, specifically in the area of electrical and electronic conductivity. While general knowledge about conductive polymers and plastics has been available for many years, a true understanding of their application has only taken place in the last 3 to 4 years. This is attributed to advances in materials and processing techniques. Engineers have only begun to explore the design freedom and economic benefits of specifying conductive polymers and plastics in industrial and business applications. This book is a key reference and guide to the use of conductive polymers and plastics. It is a summary of existing technologies, but also a look at future possibilities. There are many books available on polymer chemistry, properties, and processing, but they do not focus on the practicalities of selecting and using them correctly in the design of structures. Engineering students require an understanding of polymers and composites as well as viscoelasticity, adhesion, damping applications, and tribology in order to successfully integrate these materials into their designs. Based on more than twenty years of classroom experience, Engineering Design with Polymers and Composites is the first textbook to unite these topics in a single source. The authors take a bottom-up functional approach rather than a top-down analytical approach to design. This unique perspective enables students to select the proper materials for the application rather than force the design to suit the materials. The text begins with an introduction to polymers and composites, including historical background. Detailed coverage of mechanical properties, viscoelastic behavior of polymers, composite materials, creep and fatigue failure, impact, and related properties follows. Discussion then turns to selection of materials, design applications of polymers, polymer processing, adhesion, tribology, and damping and isolation. Abundant examples, homework problems, tables, and illustrations reinforce the concepts. Accompanied by a CD-ROM containing materials databases, examples in Excel®, and a laminate analysis program, Engineering Design with Polymers and Composites builds a strong background in the underlying concepts necessary for engineering students to successfully incorporate polymers and composites into their designs. This book is derived from a recent project sponsored by the Polymer Engineering Directorate of the SERC and carried out at the University of Lancaster under the joint auspices of the Departments of Chemistry and Engineering. The project set out to provide a novel type of teaching material for introducing polymers and their uses to students, especially of engineering. Case studies of real examples of polymers at work are used, so the

student or teacher can start with a successful and well-designed product and work backwards to its origins in the market, in design and material selection and in the manufacturing process. The philosophy is that such an approach captures interest right at the start by means of a real example and then retains it because of the relevance of the technical explanation. This after all is what most of us do habitually; we turn to examples to make our point. The hope is that subject matter with a somewhat notorious reputation among engineers, such as aspects of polymer chemistry and the non-linear behaviour of polymers under mechanical loading will be fairly painlessly absorbed through the context of the examples. Each study becomes a separate chapter in the book. The original studies, and hence the present chapters, vary in length because different topics demanded different approaches. No attempt has been made to alter this, or to adopt a standardized format because to have done so would have interfered with the vitality of the original work. This new book offers practical insights into the latest developments in responsive polymers, i.e., polymers engineered to alter structure and properties in response to environmental inputs. The book features original design, methodological, and application data. Chemists, biochemists, and electronic engineers will find here important new material to understand and characterize molecular and submolecular assemblies that enable the fabrication of switch-driven polymer systems. Beginning from basic research and moving to single-molecular design, the contributors illuminate switching in self-assembled aggregates of polymer chains. These analyses are extended to the switching/changing of macroscopic properties in bulk and thin films. The book demonstrates how the properties of responsive polymers such as morphology, wetting behavior, adhesion, roughness, permeability etc., can be modified to create and improve biomedical devices, chemical sensors, microfluidic devices, drug delivery systems, adhesion systems, and self-regulating colloids. For specialists investigating the potential of molecular and submolecular polymer design, this book is essential. Over 30% of commercial polymers are blends or alloys or one kind or another. Nanostructured blends offer the scientist or plastics engineer a new range of possibilities with characteristics including thermodynamic stability; the potential to improve material transparency, creep and solvent resistance; the potential to simultaneously increase tensile strength and ductility; superior rheological properties; and relatively low cost. Nanostructured Polymer Blends opens up immense structural possibilities via chemical and mechanical modifications that generate novel properties and functions and high-performance characteristics at a low cost. The emerging applications of these new materials cover a wide range of industry sectors, encompassing the coatings and adhesives industry, electronics, energy (photovoltaics), aerospace and medical devices (where polymer blends provide innovations in biocompatible materials). This book explains the science of nanostructure formation and the nature of interphase formations, demystifies the design of nanostructured blends to achieve specific properties, and introduces the applications for this important new class of nanomaterial. All the key topics related to recent advances in blends are covered: IPNs, phase morphologies, composites and nanocomposites, nanostructure formation, the chemistry and structure of additives, etc. Introduces the science and technology of nanostructured polymer blends – and the procedures involved in melt blending and chemical blending to produce new materials with specific performance characteristics Unlocks the potential of nanostructured polymer blends for applications across sectors, including electronics, energy/photovoltaics, aerospace/automotive, and medical devices (biocompatible polymers) Explains the performance benefits in areas including rheological properties, thermodynamic stability, material transparency, solvent resistance, etc. Printing on Polymers: Fundamentals and Applications is the first authoritative reference covering the most important developments in the field of printing on polymers, their composites, nanocomposites, and gels. The book examines the current state-of-the-art and new challenges in the formulation of inks, surface activation of polymer surfaces, and various methods of printing. The book equips engineers and materials scientists with the tools required to select the correct method, assess the quality of the result, reduce costs, and keep up-to-date with regulations and environmental concerns. Choosing the correct way of decorating a particular polymer is an important part of the production process. Although printing on polymeric substrates can have desired positive effects, there can be problems associated with various decorating techniques. Physical, chemical, and thermal interactions can cause problems, such as cracking, peeling, or dulling. Safety, environmental sustainability, and cost are also significant factors which need to be considered. With contributions from leading researchers from industry, academia, and private research institutions, this book serves as a one-stop reference for this field—from print ink manufacture to polymer surface modification and characterization; and from printing methods to applications and end-of-life issues. Enables engineers to select the correct decoration method for each material and application, assess print quality, and reduce costs Increases familiarity with the terminology, tests, processes, techniques, and regulations of printing on plastic, which reduces the risk of adverse reactions, such as cracking, peeling, or dulling of the print Addresses the issues of environmental impact and cost when printing on polymeric substrates Features contributions from leading researchers from industry, academia, and private research institutions 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. A guide to designing safer polymers based on the principles of green chemistry and the EPA's Polymer Exemption Rule Green chemistry, the design of chemical products and processes that reduce or eliminate the use and generation of hazardous substances, is a powerful tool in designing safer polymers. By adhering to the principles of green chemistry, manufacturers can produce polymers that are better for the environment, and can do so in an economically sound manner. The Polymer Exemption Rule delineates types of polymers that are expected to be of reduced risk. By following the guidelines contained within the Polymer Exemption Rule, manufacturers may decrease their regulatory requirements while designing polymers that are environmentally benign. This valuable guide approaches the manufacture of polymers from two perspectives, incorporating the principles of green chemistry with the guidance of the Polymer Exemption Rule to design environmentally benign polymers. Designing Safer Polymers is an indispensable working resource for polymer scientists and engineers, as well as corporate decision makers working in the polymer and chemical industries. New technologies are made possible by new materials, and until recently new materials could only be discovered experimentally. Recent advances in solving the crystal structure prediction problem means that the computational design of materials is now a reality. Computational Materials Discovery

provides a comprehensive review of this field covering different computational methodologies as well as specific applications of materials design. The book starts by illustrating how and why first-principle calculations have gained importance in the process of materials discovery. The book is then split into three sections, the first exploring different approaches and ideas including crystal structure prediction from evolutionary approaches, data mining methods and applications of machine learning. Section two then looks at examples of designing specific functional materials with special technological relevance for example photovoltaic materials, superconducting materials, topological insulators and thermoelectric materials. The final section considers recent developments in creating low-dimensional materials. With contributions from pioneers and leaders in the field, this unique and timely book provides a convenient entry point for graduate students, researchers and industrial scientists on both the methodologies and applications of the computational design of materials.

Design and Applications of Nanostructured Polymer Blend and Nanocomposite Systems offers readers an intelligent, thorough introduction to the design and applications of this new generation of designer polymers with customized properties. The book assembles and covers, in a unified way, the state-of-the-art developments of this less explored type of material. With a focus on nanostructured polymer blends, the book discusses the science of nanostructure formation and the potential performance benefits of nanostructured polymer blends and composites for applications across many sectors: electronics, coatings, adhesives, energy (photovoltaics), aerospace, automotive, and medical devices (biocompatible polymers). The book also describes the design, morphology, and structure of nanostructured polymer composites and blends to achieve specific properties. Covers all important information for designing and selecting the right nanostructured polymer system Provides specialized knowledge on self-repairing, nanofibre and nanostructured multiphase materials, as well as evaluation and testing of nanostructured polymer systems Serves as a reference guide for development of new products in industries ranging from electronics, coatings, and energy, to transport and medical applications Describes the design, morphology, and structure of nanostructured polymer composites and blends to achieve specific properties

Create Art with Polymer Clay Whether you are a student, teacher, crafter, or have an interest in art principles, you will discover new ways to unleash your creativity while creating with polymer clay. After a brief introduction to this versatile medium, the author presents the elements and principles of design, from color and value to emphasis and unity, which apply to all media. You will explore the concepts and complete exercises - which include step-by-step instructions and illustrations - aimed at stimulating and improving your design quality and creations. This indispensable guide includes:

- More than 20 creative and functional projects
- Artwork by celebrated artists from around the world
- Hundreds of lavish full-color photos

Comprehensive. Modern. Fundamental. An essential resource. Hundreds of lavish full-color photos **Comprehensive. Modern. Fundamental. An essential resource.** This new book covers the synthetic as well application aspects of functional polymers. It highlights modern trends in the field and showcases the recent characterization techniques that are being employed in the field of polymer science. The chapters are written by top-notch scientists who are internationally recognized in the field. The chapters will highlight the modern trend in the field. 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

This volume, **Bioresponsive Polymers: Design and Application in Drug Delivery**, focuses on recent advancements in bioresponsive polymers and their design, characterization, and applications in varied fields, such as drug delivery and gene delivery. It looks at several carriers for drug delivery and biological molecules using different bioresponsive polymers. To address the many difficulties in existing dosage forms, this book provides information on recent developments to overcome drawbacks of conventional forms of the drug delivery. The chapters cover most areas of bioresponsive polymers, starting with a basic introduction to bioresponsive polymers, followed by chapters on design, characterization, and mechanism of bioresponsive polymers; and applications of drug and gene delivery using bioresponsive polymers via oral, topical, nasal, ocular, and parenteral methods. The book also reviews recent advancements in bioresponsive polymers and advanced applications, such as engineering particulate moieties, biomedical applications, hydrogels as emerging therapy, and electrochemical responses, bioresponsive nanoparticles, and bioresponsive hydrogels. Independent, practical guidance on the structural design of polymer composites is provided for the first time in this book. Structural designers familiar with design of conventional structural materials such as steel and concrete will be able to use it to design a broad range of polymeric composites for structural applications, using glass fibre reinforced plastic materials, components, connections and assemblies.

Shape-Memory Polymer Device Design discusses the latest shape-memory polymers and the ways they have started to transition out of the academic laboratory and into devices and commercial products. Safranski introduces the properties of shape-memory polymers and presents design principles for designing and manufacturing, providing a guide for the R&D engineer/scientist and design engineer to add the shape memory effect of polymers into their design toolbox. This is the first book to focus on applying basic science knowledge to design practical devices, introducing the concept of shape-memory polymers, the history of their use, and the range of current applications. It details the specific design principles for working with shape-memory polymers that don't often apply to mechanically inactive materials and products. Material selection is thoroughly discussed because chemical structure and thermo-mechanical properties are intrinsically linked to shape-memory performance. Further chapters discuss programming the temporary shape and recovery through a variety of activation methods with real world examples. Finally, current devices across a variety of markets are highlighted to show the breadth of possible applications. Demystifies shape-memory polymers, providing a guide to their properties and design principles Explores a range of current and emerging applications across sectors, including biomedical, aerospace/automotive, and consumer goods Places shape-

memory polymers in the design toolkit of R&D scientists/engineers and design engineers Discusses material selection in-depth because chemical structure and thermo-mechanical properties are intrinsically linked to shape-memory performance Engineering Design with Polymers and Composites, Second Edition continues to provide one of the only textbooks on the analysis and design of mechanical components made from polymer materials. It explains how to create polymer materials to meet design specifications. After tracing the history of polymers and composites, the text describes modern design concepts, such as weight-to-strength ratio and cost-to-strength ratio, for selecting polymers and composites for design applications. It also presents computer methods for choosing polymer materials from a database, for optimal design, and for laminated plate design. New to the Second Edition This edition rearranges many chapters and adds a significant amount of new material. Composites are now covered in two chapters, instead of one. This edition also includes entirely new chapters on polymer fusing and other assembly techniques, rapid prototyping, and piezoelectric polymers. Suitable for mechanical and civil engineering students as well as practicing engineers, this book helps readers get an edge in the rapidly changing electromechanical industry. It gives them a fundamental foundation for understanding phenomena that they will encounter in real-life applications or through subsequent study and research. Design and Fabrication of Large Polymer Constructions in Space is a groundbreaking study of the polymeric materials, advanced chemical processes, and cutting-edge technology required in the construction of large polymer-based structures for space, when all steps in the process are carried out in the space environment, whether in orbit, in deep space, or on the surface of a moon, asteroid, or planet. The book begins by introducing the fundamentals and requirements of large constructions and inflatable structures for space. The next section of the book focuses on the utilization of polymeric materials within the space environment, examining the effects on materials (vacuum, plasma, temperature), the possible approaches to polymerization both in space and in orbit, the preparation and structure of polymer composites, and the methods for testing materials and structures in terms of strength, defects, and aging. Three chapters then cover how these materials and techniques might be applied to specific categories of construction, including larger space habitats, supporting space structures, and ground infrastructure. Finally, the financial aspects, the consequences for human space exploitation, and the possible future developments are discussed. Using materials science to push the boundaries of construction for space exploration and exploitation, this book is a unique resource for academic researchers and advanced students across polymer science, advanced materials, chemical engineering, construction, and space engineering, as well as for researchers, scientists and engineers at space agencies, companies and laboratories, involved in developing materials or technology for use in space. This is also of great interest to anyone interested in the role of materials science in the building of large space stations, spacecraft, planetary bases, large aperture antenna, radiation and thermal shields, and repairmen sets. Describes the role of polymers in the construction of large space habitats, supporting space structures, and ground infrastructure Explains polymerization in the Earth's orbit and in space, covering material specifications, control of curing, and the effects of interaction with the external environment Presents the possible testing methods, including strength evaluation, defect detection, and aging tests of materials and constructions Applications of Polymers and Plastics in Medical Devices: Design, Manufacture, and Performance is a comprehensive guide to plastic materials for medical devices, covering fundamentals, materials, applications and regulatory requirements. Sections cover the role of plastics in medical devices, socioeconomic factors, the classification of medical devices. The performance of, medical grades and suppliers of polymer materials, which are categorized by performance level are also explored, along with manufacturing processes for device components, including extrusion, casting, injection molding and assembly processes. The book then covers applications in detail, examining each device and the role that polymers and plastics play in its construction and function. This is an essential resource for engineers, R&D, and other professionals working on plastics for medical devices and those in the plastics industry, medical device manufacturing, pharmaceuticals, packaging and biotechnology. In an academic setting, this book is of interest to researchers and advanced students in medical plastics, plastics engineering, polymer science, mechanical engineering, chemical engineering, biomedical engineering and materials science. Offers systematic coverage of the major classes of polymers used in medical devices, including properties, characteristics, performance, medical grades and suppliers Reviews regulatory requirements of the FDA and other global agencies, as well as considering quality control and socioeconomic factors Includes the latest advances in plastics for medical devices, such as novel applications, use of bio-based polymers, and processing of reusable medical devices This text introduces the design engineer to the basic elements and properties of polymers. These characteristics are related to solid and fluid behavior, processing, and performance of polymers.

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