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Principles of Polymerization

Polycarbonate (PC) is an important engineering thermoplastic that is currently produced in large industrial scale using bisphenol A and monomers such as phosgene. Since phosgene is highly toxic, a non-phosgene approach using diphenyl carbonate (DPC) as an alternative monomer, as developed by Asahi Corporation of Japan, is a significantly more environmentally friendly alternative. Other advantages include the use of CO₂ instead of CO as raw material and the elimination of major waste water production. However, for the production of DPC to be economically viable, reactive-distillation units are needed to obtain the necessary yields by shifting the reaction-equilibrium to the desired products and separating the products at the point where the equilibrium reaction occurs. In the field of chemical reaction engineering, there are many reactions that are suffering from the low equilibrium constant. The main goal of this research is to determine the optimal process needed to shift the reactions by using appropriate control strategies of the reactive distillation system. An extensive dynamic mathematical model has been developed to help us investigate different control and processing strategies of the reactive distillation units to increase the production of DPC. The high-fidelity dynamic models include extensive thermodynamic and reaction-

kinetics models while incorporating the necessary mass and energy balance of the various stages of the reactive distillation units. The study presented in this document shows the possibility of producing DPC via one reactive distillation instead of the conventional two-column, with a production rate of 16.75 tons/h corresponding to start reactants materials of 74.69 tons/h of Phenol and 35.75 tons/h of Dimethyl Carbonate. This represents a threefold increase over the projected production rate given in the literature based on a two-column configuration. In addition, the purity of the DPC produced could reach levels as high as 99.5% with the effective use of controls. These studies are based on simulation done using high-fidelity dynamic models.

Chemistry Beyond Chlorine

Includes bibliographical references and index.

Step Polymerization

Transformation and Utilization of Carbon Dioxide shows the various organic, polymeric and inorganic compounds which result from the transformation of carbon dioxide through chemical, photocatalytic, electrochemical, inorganic and biological processes. The book consists of twelve chapters demonstrating interesting examples of these reactions, depending on the types of reaction and catalyst. It also includes two chapters dealing with the utilization of carbon dioxide as a reaction promoter and presents a wide range of examples of chemistry and chemical engineering with carbon dioxide. Transformation and Utilization of Carbon Dioxide is a collective work of reviews illustrative of recent advances in the transformation and utilization of carbon dioxide. This book is interesting and useful to a wide readership in the various fields of chemical science and engineering. Bhalchandra Bhanage is a professor of industrial and engineering chemistry at Institute of Chemical Technology, India. Masahiko Arai is a professor of chemical engineering at Hokkaido University, Japan.

Encyclopedia of Sustainable Technologies

Synthetic Biodegradable Polymers

This textbook is intended to give an understanding of the basic principles that constitute the field of non-conventional polymers containing inorganic and organometallic units as the repeating units. Each chapter will be self-explanatory with a good background so that it can be easily understood at the senior undergraduate level. The principles involved in the preparation of these polymers, their characterisation and their applications will be discussed. Basic inorganic chemistry required for the understanding of each topic is presented so that the content of the chapter is readily understood. All the major inorganic and organometallic polymers such as polyphosphazenes, polysilanes, polysiloxanes, poly-thiazyl, poly-ferrocenes and other polymers containing main group elements will be dealt with.

Purification of Laboratory Chemicals

Now in its fifth edition, the book has been updated to include more detailed descriptions of new or more commonly used techniques since the last edition as well as remove those that are no longer used, procedures which have been developed recently, ionization constants (pKa values) and also more detail about the trivial names of compounds. In addition to having two general chapters on purification procedures, this book provides details of the physical properties and purification procedures, taken from literature, of a very extensive number of organic, inorganic and biochemical compounds which are commercially available. This is the only complete source that covers the purification of laboratory chemicals that are commercially available in this manner and format. * Complete update of this valuable, well-known reference * Provides purification procedures of commercially available chemicals and biochemicals * Includes an extremely useful compilation of ionisation constants

Green Synthesis of Heterocycles

"Summarizes research and progress in understanding the fundamental molecular properties of polycarbonates by covering history, theory, modeling, and spectroscopy. Offers the first comprehensive survey of polycarbonates in over 30 years."

CO2: A Valuable Source of Carbon

The global economy and our way of life are based on the exploitation of fossil fuels, which not only threaten massive environmental and social disruption through global warming but, at present rates of consumption, will run out within decades, causing huge industrial dislocation and economic collapse. Even before then, the conflicts it causes in the Middle East and elsewhere will be frighteningly exacerbated. The alternative exists: renewable energy from renewable sources - above all, solar. Substituting renewable for fossil resources will take a new industrial revolution to avert the worst of the damage and establish a new international order. It can be done, and it can be done in time. The Solar Economy, by one of the world's most effective analysts and advocates, lays out the blueprints, showing how the political, economic and technological challenges can be met using indigenous, renewable and universally available resources, and the enormous opportunities and benefits that will flow from doing so.

Phosgenations

Hardbound. Volume 5 discusses step polymerization and includes 16 chapters covering general characteristics of step polymerization followed by 23 chapters describing the synthesis of specific polymer types by step polymerization.

Green Chemistry and Chemical Engineering

As the annual production of carbon Dioxide (CO₂) reaches 30 billion tones, the growing issue of the greenhouse effect has triggered the development of

technologies for CO₂ sequestration, storage and use as a reactant. Collecting together the reports of the Congress at University of Rome (Campus Bio-medico) held 16th April 2012, CO₂: A Valuable Source of Carbon presents and discusses promising technologies for the industrial exploitation of CO₂. Divided into two parts, the current technology is evaluated and summarized before European and national projects are presented. The focus on CO₂ recovery, particularly in value-added production, proposes applicable methods to develop sustainable practices and even to mitigate greenhouse gas emission from large-scale fossil fuels usage. Including current data and real-world examples, CO₂: A valuable source of carbon provides students, engineers, researchers and industry professional with up-to-date material and potential areas for development and research.

Organic Polymer Chemistry

Carbon Dioxide Recovery and Utilization is a complete and informative resource on the carbon dioxide sources and market at the European Union level, with reference to the world situation. The book covers the following themes: - Sources of carbon dioxide and their purity, - Market of carbon dioxide and its uses, - Separation techniques of carbon dioxide from flue gases, - Analysis of the potential of each technique and application, - Basic science and technology of supercritical CO₂, - Reactions in supercritical CO₂ and its use as reactive solvent, - Utilization of CO₂ in the synthesis of chemicals with low energy input, - Conversion of CO₂ into fuels: existing techniques, - Dry reforming of methane, - Assessment of the use of carbon dioxide for the synthesis of methanol. This book is unique in providing integrated information and a perspective on innovative technologies for the use of carbon dioxide. The book is suitable for use as a textbook for courses in chemical engineering and chemistry. It is also of great interest as a general reference for those involved with technologies for avoiding carbon dioxide production and for economists. This is an invaluable reference for specialists on synthetic chemistry, gas separation, supercritical fluids, carbon dioxide marketing, renewable energy and sustainable development. In addition, it will be useful for those working in the chemical industry and for policy makers for carbon dioxide mitigation, innovative technologies, carbon recycling, and power generation.

Polymer Preprints, Japan

Industrial Catalysis and Separations

This expanded, revised, and updated second edition of Innovations in Green Chemistry and Green Engineering provides a comprehensive introduction to the state-of-the-art in this key area of sustainability research. Processes that meet the objectives of green chemistry and chemical engineering minimize waste and energy use, and eliminate toxic by-products. Given the ubiquitous nature of products from chemical processes in our lives, green chemistry and chemical engineering are vital components of any sustainable future. Peer-reviewed articles from worldwide experts present the latest developments on topics ranging from organic batteries and green catalytic transformations to green nanoscience and nanotoxicology. Now under the leadership of distinguished Editors from the

Chinese Academy of Sciences, this volume in the Encyclopedia of Sustainability Science and Technology, Second Edition, is an essential, one-stop reference for professionals in research and industry. The book also fills the need for an authoritative course text in environmental and green chemistry and chemical engineering at the upper-division undergraduate and graduate levels.

Handbook of Ring-Opening Polymerization

A couple of years ago a small group of people began discussing the possibility of running an advanced summer school in the area of polymer blends. There had been a number of recent advances in this field, and given the considerable interest in these new polymeric materials, we thought such a meeting would be well received both by industry and academia. We wanted it to contain a wide range of background science and technology and also up to date recent advances in the field. It became clear as the discussion progressed that the experts in the field were scattered over the length and breadth of Europe and North America and thus the cost of bringing them together for a summer school would necessitate a high registration fee which would deter many of the research workers we wished to attract. The NATO Advanced Study Institute programme enables a subject to be covered in depth and by giving generous funds to cover lecturers' costs ensures that a wide spectrum of research workers can attend. We decided to apply to NATO and this book contains the results of our request. The ASI was funded under the 'Double-Jump' Programme which is not a new Olympic event but a way of supporting courses on subjects of direct industrial interest. The Institute was also backed by donations from several companies and approximately half those attending were from industrial organisations.

SPSJ Annual Meeting

Encyclopedia of Sustainable Technologies provides an authoritative assessment of the sustainable technologies that are currently available or in development. Sustainable technology includes the scientific understanding, development and application of a wide range of technologies and processes and their environmental implications. Systems and lifecycle analyses of energy systems, environmental management, agriculture, manufacturing and digital technologies provide a comprehensive method for understanding the full sustainability of processes. In addition, the development of clean processes through green chemistry and engineering techniques are also described. The book is the first multi-volume reference work to employ both Life Cycle Analysis (LCA) and Triple Bottom Line (TBL) approaches to assessing the wide range of technologies available and their impact upon the world. Both approaches are long established and widely recognized, playing a key role in the organizing principles of this valuable work. Provides readers with a one-stop guide to the most current research in the field Presents a grounding of the fundamentals of the field of sustainable technologies Written by international leaders in the field, offering comprehensive coverage of the field and a consistent, high-quality scientific standard Includes the Life Cycle Analysis and Triple Bottom Line approaches to help users understand and assess sustainable technologies

This book, cohesively written by an expert author with supreme breadth and depth of perspective on polyurethanes, provides a comprehensive overview of all aspects of the science and technology on one of the most commonly produced plastics. Covers the applications, manufacture, and markets for polyurethanes, and discusses analytical methods, reaction mechanisms, morphology, and synthetic routes Provides an up-to-date view of the current markets and trend analysis based on patent activity and updates chapters to include new research Includes two new chapters on PU recycling and PU hybrids, covering the opportunities and challenges in both

Monomers, Polymers and Composites from Renewable Resources

The new edition of a classic text and reference The large chains of molecules known as polymers are currently used in everything from "wash and wear" clothing to rubber tires to protective enamels and paints. Yet the practical applications of polymers are only increasing; innovations in polymer chemistry constantly bring both improved and entirely new uses for polymers onto the technological playing field. Principles of Polymerization, Fourth Edition presents the classic text on polymer synthesis, fully updated to reflect today's state of the art. New and expanded coverage in the Fourth Edition includes: * Metallocene and post-metallocene polymerization catalysts * Living polymerizations (radical, cationic, anionic) * Dendrimer, hyperbranched, brush, and other polymer architectures and assemblies * Graft and block copolymers * High-temperature polymers * Inorganic and organometallic polymers * Conducting polymers * Ring-opening polymerization * In vivo and in vitro polymerization Appropriate for both novice and advanced students as well as professionals, this comprehensive yet accessible resource enables the reader to achieve an advanced, up-to-date understanding of polymer synthesis. Different methods of polymerization, reaction parameters for synthesis, molecular weight, branching and crosslinking, and the chemical and physical structure of polymers all receive ample coverage. A thorough discussion at the elementary level prefaces each topic, with a more advanced treatment following. Yet the language throughout remains straightforward and geared towards the student. Extensively updated, Principles of Polymerization, Fourth Edition provides an excellent textbook for today's students of polymer chemistry, chemical engineering, and materials science, as well as a current reference for the researcher or other practitioner working in these areas.

Polymer Blends and Mixtures

Environmental chemistry is a new, fast developing science aimed at deciphering fundamental mechanisms ruling the behaviour of pollutants in ecosystems. Applying this knowledge to current environmental issues leads to the remediation of environmental media, and to new, low energy, low emission, sustainable processes. This book describes the state-of-the-art advances regarding the pollution of water, soils, atmosphere, food and living organisms by toxic metals, fossil fuels, pesticides and other organic pollutants. Furthermore, the eco-

toxicology section presents novel bio-assays to assess the toxicity of various pollutants such as dioxins and endocrine disrupters within complex media. The green chemistry section highlights novel chemical reactions based upon environmentally friendly conditions. The analytical chemistry section describes very sensitive methods which trace the fate of pollutants in complex ecosystems.

Green Chemistry

In this manual, the authors compare the range of applications for phosgene with that of the alternative compounds, dealing in detail with the possible uses of diphosgene, triphosgene, carbon dioxide, organic carbonates, oxalylchloride and many other alternative materials used in synthesis. However, they clearly point out those cases where phosgene continues to have the advantage. The result is a mine of information for synthetic chemists working in industry and academia faced with the question of where the toxic phosgene can be replaced by an unproblematic compound - including the safety phosgenation.

The Solar Economy

In recent years the need for sustainable process design and alternative reaction routes to reduce industry's impact on the environment has gained vital importance. The book begins with a general overview of new trends in designing industrial chemical processes which are environmentally friendly and economically feasible. Specific examples written by experts from industry cover the possibilities of running industrial chemical processes in a sustainable manner and provide an up-to-date insight into the main concerns, e.g., the use of renewable raw materials, the use of alternative energy sources in chemical processes, the design of intrinsically safe processes, microreactor and integrated reaction/ separation technologies, process intensification, waste reduction, new catalytic routes and/or solvent and process optimization.

Handbook of Telechelic Polyesters, Polycarbonates, and Polyethers

A Comprehensive Review of Developing Environmentally Friendly Lubricants A push from environmentally savvy consumers along with recent changes in governmental regulations have paved the way for a marketplace of products with high levels of environmental performance. Fueled by the growing demand for biobased lubricants, Environmentally Friendly and Biobased Lubricants highlights the development of environmentally friendly additives that are compatible with environmental regulations and describes the approaches being used in this emerging area. Derived from research topics shared over the years at various technical sessions of the Society of Tribologists and Lubrication Engineers (STLE) Annual Meetings, the book includes a critical assessment of gaps and weaknesses in the field of environmentally friendly fluids and biobased lubricants. Each chapter is written by authors selected from the environmentally friendly fluids and biobased lubricants sessions of STLE and also incorporates input from prominent researchers invited to take part in the book. Expert contributors discuss the control, production, usage, and disposal of lubricants; factor in related policies,

laws, and regulations around the world; and include case studies demonstrating the uses and values of commercially viable biobased lubricants. The book is divided into five sections that cover advanced environmentally friendly base oils and feedstocks, biobased hydraulic lubricants and biodegradability, chemically/enzymatically modified environmentally friendly base oils, vegetable oil-based environmentally friendly fluids, and additives for environmentally friendly fluids.

Transformation and Utilization of Carbon Dioxide

Telechelic polymers have garnered a great deal of scientific interest due to their reactive chain-end functions. This comprehensive book compiles and details the basic principles of and cutting-edge research in telechelic polyesters, polycarbonates, and polyethers, ranging from synthesis to applications. It discusses general strategies toward telechelic polymers, centered on the fundamental aspects of polycondensation reactions, of cationic, anionic, coordination-insertion, and activated monomer mechanisms of the metal-, enzyme-, or otherwise organocatalyzed ring-opening polymerization of cyclic monomers, and of postpolymerization chemical modification methods of polymer precursors. All main classes of polymers are covered separately, comprising polyhydroxyalkanoates, poly(ϵ -caprolactone)s, poly(lactic acid)s, polylactides, polycarbonates, and polyethers, including synthetic approaches as well as some illustrative, up-to-date examples and uses. The book also addresses applications of hydroxyl, thiol, amino, or acrylate/methacrylate end-capped polymers as starting materials for the preparation of diverse polymer architectures ranging from block, graft, and star-shaped polymers and micelles to precursors for ATRP macroinitiators, polyurethane copolymers, shape-memory polymers, or nanosized drug delivery systems. The book will appeal to advanced undergraduate- and graduate-level students of polymer science; researchers in macromolecular science, especially those with an interest in functional and reactive polymers; and polymer chemists in academia and industry.

Handbook of Polycarbonate Science and Technology

In the quest to mitigate the buildup of greenhouse gases in Earth's atmosphere, researchers and policymakers have increasingly turned their attention to techniques for capturing greenhouse gases such as carbon dioxide and methane, either from the locations where they are emitted or directly from the atmosphere. Once captured, these gases can be stored or put to use. While both carbon storage and carbon utilization have costs, utilization offers the opportunity to recover some of the cost and even generate economic value. While current carbon utilization projects operate at a relatively small scale, some estimates suggest the market for waste carbon-derived products could grow to hundreds of billions of dollars within a few decades, utilizing several thousand teragrams of waste carbon gases per year. *Gaseous Carbon Waste Streams Utilization: Status and Research Needs* assesses research and development needs relevant to understanding and improving the commercial viability of waste carbon utilization technologies and defines a research agenda to address key challenges. The report is intended to help inform decision making surrounding the development and deployment of waste carbon utilization technologies under a variety of circumstances, whether

motivated by a goal to improve processes for making carbon-based products, to generate revenue, or to achieve environmental goals.

Non-Phosgene Polycarbonate from CO₂ - Industrialization of Green Chemical Process

Understanding the reactivity of monomers is crucial in creating copolymers and determining the outcome of copolymerization. Covering the fundamental aspects of polymerization, *Synthesis and Applications of Copolymers* explores the reactivity of monomers and reaction conditions that ensure that the newly formed polymeric materials exhibit desired properties. Referencing a wide-range of disciplines, the book provides researchers, students, and scientists with the preparation of a diverse variety of copolymers and their recent developments, with a particular focus on copolymerization, crystallization, and techniques like nanoimprinting and micropatterning.

Synthesis and Applications of Copolymers

Gaseous Carbon Waste Streams Utilization

Salen Metal Complexes as Catalysts for the Synthesis of Polycarbonates from Cyclic Ethers and Carbon Dioxide, by Donald J. Darensbourg.- Material Properties of Poly(Propylene Carbonates), by Gerrit. A. Luinstra and Endres Borchardt.- Poly(3-Hydroxybutyrate) from Carbon Monoxide, by Robert Reichardt and Bernhard Rieger. - Ecoflex® and Ecovio®: Biodegradable, Performance-Enabling Plastics, by K. O. Siegenthaler, A. Künkel, G. Skupin and M. Yamamoto.- Biodegradability of Poly(Vinyl Acetate) and Related Polymers, by Manfred Amann and Oliver Minge.- Recent Developments in Ring-Opening Polymerization of Lactones, by P. Lecomte and C. Jérôme.- Recent Developments in Metal-Catalyzed Ring-Opening Polymerization of Lactides and Glycolides: Preparation of Polylactides, Polyglycolide, and Poly(lactide-co-glycolide), by Saikat Dutta, Wen-Chou Hung, Bor-Hunn Huang and Chu-Chieh Lin.- Bionolle (Polybutylenesuccinate), by Yasushi Ichikawa, Tatsuya Mizukoshi.- Polyurethanes from Renewable Resources, by David A. Babb.-

Advances in Polycarbonates

This comprehensive, truly one-stop reference discusses monomers, methods, stereochemistry, industrial applications and more. Chapters written by internationally acclaimed experts in their respective fields cover both basic principles and up-to-date information, ranging from the controlled ring-opening polymerization methods to polymer materials of industrial interest. All main classes of monomers including heterocyclics, cyclic olefins and alkynes, and cycloalkanes, are discussed separately as well as their specificities regarding the ring-opening polymerization techniques, the mechanisms, the degree of control, the properties of the related polymers and their applications. The two last chapters are devoted to the implementation of green chemistry in ring-opening polymerization processes. Of much interest to chemists in academia and industry.

Carbon Dioxide Recovery and Utilization

The first English edition of this book was published in 1971 with the late Prof. Dr. Werner Kern as coauthor. In 1997, for the preparation of the third edition, Prof. Dr. Helmut Ritter joined the team of authors and in 2001 Prof. Dr. Brigitte Voit and Prof. Dr. Matthias Rehahn complemented this team. The change in authors has not altered the basic concept of this 4th edition: again we were not aimed at compiling a comprehensive collection of recipes. In stead, we attempted to reach a broader description of the general methods and techniques for the synthesis, modification, and characterization of macromolecules, supplemented by 105 selected and detailed experiments and by sufficient theoretical treatment so that no additional textbook be needed in order to understand the experiments. In addition to the preparative aspects we have also tried to give the reader an impression of the relation of chemical structure and morphology of polymers to their properties, as well as of areas of their application.

CO2 Sequestration and Valorization

Since the industrial revolution, chlorine remains an iconic molecule even though its production by the electrolysis of sodium chloride is extremely energy intensive. The rationale behind this book is to present useful and industrially relevant examples for alternatives to chlorine in synthesis. This multi-authored volume presents numerous contributions from an international spectrum of authors that demonstrate how to facilitate the development of industrially relevant and implementable breakthrough technologies. This volume will interest individuals working in organic synthesis in industry and academia who are working in Green Chemistry and Sustainable Technologies.

Sustainable Industrial Chemistry

Presents the alternative environmentally benign syntheses and processes for chemical manufacturing. Introduces green chemistry technologies, including biotechnology for pollution prevention. Presents alternative environmentally benign reaction conditions for chemical manufacturing. Discusses the use of catalysis for pollution prevention.

Encyclopedia and Handbook of Materials, Parts and Finishes

A great deal of progress has been made in the development of materials, their application to structures, and their adaptation to a variety of systems and integrated across a wide range of industrial applications. This encyclopedia serves the rapidly expanding demand for information on technological developments. In addition to providing information

Polyurethanes

With contributions from experts from both the industry and academia, this book presents the latest developments in the identified areas. In addition, a thorough and updated coverage of the traditional aspects of heterogeneous catalysis such

as preparation, characterization and use in well-established technologies such as nitration, ammoxidation and hydrofluorination is included. This book incorporates appropriate case studies, explanatory notes, and schematics for more clarity and better understanding.

Inorganic and Organometallic Polymers

Environmental chemistry is a new, fast developing science aimed at deciphering fundamental mechanisms ruling the behaviour of pollutants in ecosystems. Applying this knowledge to current environmental issues leads to the remediation of environmental media, and to new, low energy, low emission, sustainable processes. This book describes the state-of-the-art advances regarding the pollution of water, soils, atmosphere, food and living organisms by toxic metals, fossil fuels, pesticides and other organic pollutants. Furthermore, the ecotoxicology section presents novel bio-assays to assess the toxicity of various pollutants such as dioxins and endocrine disrupters within complex media. The green chemistry section highlights novel chemical reactions based upon environmentally friendly conditions. The analytical chemistry section describes very sensitive methods which trace the fate of pollutants in complex ecosystems.

Plastics and the Environment

New and Future Developments in Catalysis

Advances in Polycarbonates includes such topics as theory and modelling, synthesis of new polycarbonates, characterization, development of enhanced properties in polycarbonates (such as conductivity, weatherability, higher heat or better low temperature ductility), recycling, and process chemistry. A variety of international researchers from industry, government, and academia have provided a diverse array of recent research. BPA-Polycarbonate is a versatile engineering material with a combination of many important properties: optical-quality transparency and birefringence, high refractive index, high glass transition temperature, exceptional impact strength and good processability. Fifty years after its discovery, academic and industrial polycarbonate research continues to grow annually. Polycarbonates are used in a very large variety of applications, ranging from optical recording media (CD, DVD, etc.), sporting equipment, unbreakable glazing materials, lighting, medical equipment, and automotive exteriors and interiors.

Environmentally Friendly and Biobased Lubricants

The progressive dwindling of fossil resources, coupled with the drastic increase in oil prices, have sparked a feverish activity in search of alternatives based on renewable resources for the production of energy. Given the predominance of petroleum- and carbon-based chemistry for the manufacture of organic chemical commodities, a similar preoccupation has recently generated numerous initiatives aimed at replacing these fossil sources with renewable counterparts. In particular, major efforts are being conducted in the field of polymer science and technology to

prepare macromolecular materials based on renewable resources. The concept of the bio-refinery, viz. the rational exploitation of the vegetable biomass in terms of the separation of its components and their utilisation as such, or after suitable chemical modifications, is thus gaining momentum and considerable financial backing from both the public and private sectors. This collection of chapters, each one written by internationally recognised experts in the corresponding field, covers in a comprehensive fashion all the major aspects related to the synthesis, characterization and properties of macromolecular materials prepared using renewable resources as such, or after appropriate modifications. Thus, monomers such as terpenes and furans, oligomers like rosin and tannins, and polymers ranging from cellulose to proteins and including macromolecules synthesized by microbes, are discussed with the purpose of showing the extraordinary variety of materials that can be prepared from their intelligent exploitation. Particular emphasis has been placed on recent advances and imminent perspectives, given the incessantly growing interest that this area is experiencing in both the scientific and technological realms. Discusses bio-refining with explicit application to materials Replete with examples of applications of the concept of sustainable development Presents an impressive variety of novel macromolecular materials

Polymer Synthesis: Theory and Practice

The reconciliation of economic development, social justice and reduction of greenhouse gas emissions is one of the biggest political challenges of the moment. Strategies for mitigating CO₂ emissions on a large scale using sequestration, storage and carbon technologies are priorities on the agendas of research centres and governments. Research on carbon sequestration is the path to solving major sustainability problems of this century a complex issue that requires a scientific approach and multidisciplinary and interdisciplinary technology, plus a collaborative policy among nations. Thus, this challenge makes this book an important source of information for researchers, policymakers and anyone with an inquiring mind on this subject.

Environmental Chemistry

New and Future Developments in Catalysis is a package of books that compile the latest ideas concerning alternate and renewable energy sources and the role that catalysis plays in converting new renewable feedstock into biofuels and biochemicals. Both homogeneous and heterogeneous catalysts and catalytic processes will be discussed in a unified and comprehensive approach. There will be extensive cross-referencing within all volumes. This volume presents a complete picture of all carbon dioxide (CO₂) sources, outlines the environmental concerns regarding CO₂, and critically reviews all current CO₂ activation processes. Furthermore, the volume discusses all future developments and gives a critical economic analysis of the various processes. Offers in-depth coverage of all catalytic topics of current interest and outlines future challenges and research areas A clear and visual description of all parameters and conditions, enabling the reader to draw conclusions for a particular case Outlines the catalytic processes applicable to energy generation and design of green processes

Plastics offer a variety of environmental benefits. However, their production, applications, and disposal present many environmental concerns. *Plastics and the Environment* provides state-of-the-art technical and research information on the complex relationship between the plastic and polymer industry and the environment, focusing on the sustainability, environmental impact, and cost—benefit tradeoffs associated with different technologies. Bringing together the field's leading researchers, Anthony Andrady's innovative collection not only covers how plastics affect the environment, but also how environmental factors affect plastics. The relative benefits of recycling, resource recovery, and energy recovery are also discussed in detail. The first of the book's four sections represents a basic introduction to the key subject matter of plastics and the environment; the second explores several pertinent applications of plastics with environmental implications—packaging, paints and coatings, textiles, and agricultural film use. The third section discusses the behavior of plastics in some of the environments in which they are typically used, such as the outdoors, in biotic environments, or in fires. The final section consists of chapters on recycling and thermal treatment of plastics waste. Chapters include: Commodity Polymers Plastics in Transportation Biodegradation of Common Polymers Thermal Treatment of Polymer Waste Incineration of Plastics The contributors also focus on the effectiveness of recent technologies in mitigating environmental impacts, particularly those for managing plastics in the solid waste stream. Plastic and design engineers, polymer chemists, material scientists, and ecologists will find *Plastics and the Environment* to be a vital resource to this critical industry.

Dynamics and Control of Reactive Distillation Process for Monomer Synthesis of Polycarbonate Plants

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.

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