This book discusses synthesis and characterization of sustainable polymers. The book covers opportunities and challenges of using sustainable polymers to replace existing petroleum based feedstock. This volume provides insights into the chemistry of polymerization, and discusses tailoring the properties of the polymers at the source in order fit requirements of specific applications. The book also covers processing of these polymers and their critical assessment. The book will be of use to chemists and engineers in the industry and academia working on sustainable polymers and their commercialization to replace dependence on petroleum-based polymers.

The most current guide to solid state polymerization Solid State Polymerization (SSP) is an indispensable tool in the design, manufacture, and study of polymers, plastics, and fibers. SSP presents significant advantages over other polymerization techniques due to low operating temperatures, inexpensive equipment, and simple and environmentally sound procedures. Combining fundamentals of polymer science, chemistry, physical chemistry, and engineering, SSP also offers many research applications for a wide range of students and investigators. Gathering and filtering the latest literature on SSP, Solid Solid State Polymerization offers a unique, one-stop resource on this important process. With chapters contributed by leaders in the field, this text summarizes SSP, and provides essential coverage that includes: An introduction to SSP, with chemical and physical steps, apparatus, advantages, and parameters SSP physical chemistry and mechanisms Kinetic aspects of polyesters and polyamides SSP Catalysis in SSP processes Application of SSP under high pressure conditions in the laboratory Engineering aspects regarding process modeling and industrial application Recent developments and future possibilities Solid State Polymerization provides the most up-to-date coverage of this constantly developing field to academic and industry professionals, as well as graduate and postgraduate-level students in chemical engineering, materials science and engineering, polymer chemistry, polymer processing and polymer engineering.

Urbanization, industrialization, and unethical agricultural practices have considerably negative effects on the environment, flora, fauna, and the health and safety of humanity. Over the last decade, green chemistry research has focused on discovering and utilizing safer, more environmentally friendly processes to synthesize products like organic compounds, inorganic compounds, medicines, proteins, enzymes, and food supplements. These green processes exist in other interdisciplinary fields of science and technology, like chemistry, physics, biology, and biotechnology, Still the majority of processes in these fields use and
generate toxic raw materials, resulting in techniques and byproducts which damage the environment. Green chemistry principles, alternatively, consider preventing waste generation altogether, the atom economy, using less toxic raw materials and solvents, and opting for reducing environmentally damaging byproducts through energy efficiency. Green chemistry is, therefore, the most important field relating to the sustainable development of resources without harmfully impacting the environment. This book provides in-depth research on the use of green chemistry principles for a number of applications.

Exploring the chemistry of synthesis, mechanisms of polymerization, reaction engineering of step-growth and chain-growth polymerization, polymer characterization, thermodynamics and structural, mechanical, thermal and transport behavior of polymers as melts, solutions and solids, Fundamentals of Polymer Engineering, Third Edition covers essential concepts and breakthroughs in reactor design and polymer production and processing. It contains modern theories and real-world examples for a clear understanding of polymer function and development. This fully updated edition addresses new materials, applications, processing techniques, and interpretations of data in the field of polymer science. It discusses the conversion of biomass and coal to plastics and fuels, the use of porous polymers and membranes for water purification, and the use of polymeric membranes in fuel cells. Recent developments are brought to light in detail, and there are new sections on the improvement of barrier properties of polymers, constitutive equations for polymer melts, additive manufacturing and polymer recycling. This textbook is aimed at senior undergraduate students and first year graduate students in polymer engineering and science courses, as well as professional engineers, scientists, and chemists. Examples and problems are included at the end of each chapter for concept reinforcement.

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.

"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."

Green Synthetic Approaches for Biologically Relevant Heterocycles, Second Edition, Volume One: Advanced Synthetic Techniques reviews this significant group of organic compounds within the context of sustainable methods and processes, expanding on the first edition with fully updated coverage and a whole range of new chapters. Volume One explores advanced synthetic techniques, with each chapter presenting in-depth coverage of various green protocols for the synthesis of a wide variety of bioactive heterocycles that are classified on the basis of ring-size and/or the presence of heteroatoms. Techniques covered range from high pressure cycloaddition reactions and microwave irradiation to sustainable one-pot domino reactions. This updated edition is an essential resource on sustainable approaches for academic researchers, R&D professionals, and students working across medicinal, organic, natural product and green chemistry. Provides fully updated coverage of the field of greener heterocycle synthesis Includes new chapters on varied multicomponent reactions, alongside both traditional and novel approaches Presents information in an accessible style with an emphasis on sustainability

Understanding the chemistry underlying sustainable energy is central to any long-term solution to meeting our future energy needs. Chemistry of Sustainable Energy presents chemistry through the lens of several sustainable energy options, demonstrating the breadth and depth of research being carried out to address issues of sustainability and the global energy demand. The author, an organic chemist, reinforces fundamental principles of chemistry as they relate to renewable or sustainable energy generation throughout the book. Written with a qualitative, structural bias, this survey text illustrates the increasingly interdisciplinary nature of chemistry research with examples from the literature to provide relevant snapshots of how solutions are developed, providing a broad foundation for further exploration. It examines those areas of energy conversion that show the most promise of achieving sustainability at this point, namely, wind power, fuel cells, solar photovoltaics, and biomass conversion processes. Next-generation nuclear power is addressed as well. This book also covers topics related to energy and energy generation that are closely tied to
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 polyhydroxalkanoates, poly(α-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.

Biodegradable aliphatic polycarbonates are important components of non-toxic thermoplastic elastomers, which have a variety of medical applications. Industrially, aliphatic polycarbonates derived from six-membered cyclic carbonates such as trimethylene carbonate (TMC or 1,3-dioxan-2-one) are produced via ring-opening polymerization (ROP) processes in the presence of a tin catalyst. It is worth mentioning that TMC is readily obtained by transesterification of 1,3-propanediol with various reagents including phosgene and its derivatives. Therefore, it has been of great interest to investigate greener routes for the production of this important class of polymers. Toward this goal, the synthesis of aliphatic polycarbonates via the metal catalyzed alternative coupling of oxetanes and carbon dioxide represents an attractive alternative. The use of an abundant, inexpensive, non-toxic, and biorenewable resource, carbon dioxide, makes this method very valuable. Furthermore, in this reaction, the six-membered cyclic carbonate byproduct, TMC, can also be ring-opened and transformed into the same polycarbonate. For over a decade, the Darenbourg research group has successfully utilized metal salen complexes as catalysts for the epoxide/CO2 copolymerization process. Hence, this dissertation focuses on the examination of these complexes as catalysts for the oxetane/CO2 copolymerization reaction and the further elucidation of its mechanism. Chromium(III) salen derivatives in the presence of an azide ion initiator were determined to be very effective catalysts for the coupling of oxetanes and carbon dioxide providing polycarbonates with minimal amounts of ether linkages. Kinetic and mechanistic investigations performed on this process suggested that copolymer formation proceeded by two routes. These are the direct enchainment of oxetane and CO2, and the intermediacy of trimethylene carbonate, which was observed as a minor product of the coupling reaction. Anion initiators which are good leaving groups, e.g. bromide and iodide, are effective at affording TMC, and hence, more polycarbonate can be formed by the ROP of preformed trimethylene carbonate. Research efforts at tuning the selectivity of the oxetane/CO2 coupling process for TMC and/or polycarbonate produced from the homopolymerization of preformed TMC have been performed using cobalt(II) salen derivatives along with anion initiators. Lastly, investigations of this process involving 3-methoxy-methyl-3-methyloxetane will be presented.

Green, sustainable chemistry involves the designing of chemical processes with a view to reducing or even eliminating the use and production of hazardous materials. Recent endeavors have focused on limiting the use of organic solvents and replacing them with new, environmentally benign media. The chemical industry is interested in these cost-effective, alternative solvents and processes. This book provides a broad overview of the three most commonly used green reaction media. Directed at synthetic organic chemists working in academic and industrial laboratories, it will also serve as a textbook for graduate courses on green chemistry. Successful green reactions are considered, and experimental sections at the end of the chapters provide important practical details, with illustrations of potential applications. Sufficient information is included to allow selection of the most appropriate medium. Extensively referenced, the volume offers a point of entry into the detailed literature.
This book is devoted to CO2 capture and utilization (CCU) from a green, biotechnological and economic perspective, and presents the potential of, and the bottlenecks and breakthroughs in converting a stable molecule such as CO2 into specialty chemicals and materials or energy-rich compounds. The use of renewable energy (solar, wind, geothermal, hydro) and non-fossil hydrogen is a must for converting large volumes of CO2 into energy products, and as such, the authors explore and compare the availability of hydrogen from water using these sources with that using oil or methane. Divided into 13 chapters, the book offers an analysis of the conditions under which CO2 utilization is possible, and discusses CO2 capture from concentrated sources and the atmosphere. It also analyzes the technological (non-chemical) uses of CO2, carbonation of basic minerals and industrial sludge, and the microbial-catalytic-electrochemical-photoelectrochemical-plasma conversion of CO2 into chemicals and energy products. Further, the book provides examples of advanced bioelectrochemical syntheses and RuBisCO engineering, as well as a techno-energetic and economic analysis of CCU. Written by leading international experts, this book offers a unique perspective on the potential of the various technologies discussed, and a vision for a sustainable future. Intended for graduates with a good understanding of chemistry, catalysis, biotechnology, electrochemistry and photochemistry, it particularly appeals to researchers (in academia and industry) and university teachers.

Adopting a didactic approach at an advanced, masters level, this concise textbook provides an array of questions & answers and features numerous industrial case studies and examples, with references for further, more detailed reading and to the latest peer-reviewed articles at the end of each chapter. A significant feature is the book’s treatment of more recently developed catalytic processes and their applications in the pharmaceutical and fine chemical industries, with an indication of their present and future commercial impact. Written by a dedicated lecturer with a wealth of experience in industry, this is an invaluable tool for practicing chemical engineers and chemists who need to advance their education in this vibrant and expanding field.

This book provides comprehensive coverage on the latest developments of research in the ever-expanding area of polymers and advanced materials and their applications to broad scientific fields including physics, chemistry, biology, and materials. It presents physical principles in explaining and rationalizing polymeric phenomena. Featuring classical topics that are conventionally considered as part of chemical technology, the book covers the chemical principles from a modern point of view. It analyzes theories to formulate and prove the polymer principles and offers future outlooks on applications of bioscience in chemical concepts.

The proposed book will be divided into three parts. The chapters in Part I provide an overview of certain aspect of process retrofitting. The focus of Part II is on computational techniques for solving process retrofit problems. Finally, Part III addresses retrofit applications from diverse process industries. Some chapters in the book are contributed by practitioners whereas others are from academia. Hence, the book includes both new developments from research and also practical considerations. Many chapters include examples with realistic data. All these feature make the book useful to industrial engineers, researchers and students.

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.
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 a 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.

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.

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.

Filling the need for an up-to-date handbook, this ready reference closely investigates the use of CO2 for ureas, enzymes, carbamates, and isocyanates, as well as its use as a solvent, in electrochemistry, biomass utilization and much more. Edited by an internationally renowned and experienced researcher, this is a comprehensive source for every synthetic chemist in academia and industry.

The series Topics in Heterocyclic Chemistry presents critical reviews on present and future trends in the research of heterocyclic compounds. Overall the scope is to cover topics dealing with all areas within heterocyclic chemistry, both experimental and theoretical, of interest to the general heterocyclic chemistry community. The series consists of topic related volumes edited by renowned editors with contributions of experts in the field. All chapters from Topics in Heterocyclic Chemistry are published Online First with an individual DOI. In references, Topics in Heterocyclic Chemistry is abbreviated as Top Heterocycl Chem and cited as a journal.
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.

This second edition Encyclopedia supplies nearly 350 gold standard articles on the methods, practices, products, and standards influencing the chemical industries. It offers expertly written articles on technologies at the forefront of the field to maximize and enhance the research and production phases of current and emerging chemical manufacturing practices and techniques. This collecting of information is of vital interest to chemical, polymer, electrical, mechanical, and civil engineers, as well as chemists and chemical researchers. A complete reconceptualization of the classic reference series the Encyclopedia of Chemical Processing and Design, whose first volume published in 1976, this resource offers extensive A-Z treatment of the subject in five simultaneously published volumes, with comprehensive indexing of all five volumes in the back matter of each tome. It includes material on the design of key unit operations involved with chemical processes; the design, unit operation, and integration of reactors and separation systems; process system peripherals such as pumps, valves, and controllers; analytical techniques and equipment; and pilot plant design and scale-up criteria. This reference contains well-researched sections on automation, equipment, design and simulation, reliability and maintenance, separations technologies, and energy and environmental issues. Authoritative contributions cover chemical processing equipment, engineered systems, and laboratory apparatus currently utilized in the field. It also presents expert overviews on key engineering science topics in property predictions, measurements and analysis, novel materials and devices, and emerging chemical fields. ALSO AVAILABLE ONLINE This Taylor & Francis encyclopedia is also available through online subscription, offering a variety of extra benefits for both researchers, students, and librarians, including: Citation tracking and alerts Active reference linking Saved searches and marked lists HTML and PDF format options Contact Taylor and Francis for more information or to inquire about subscription options and print/online combination packages. US: (Tel) 1.888.318.2367; (E-mail) e-reference@taylorandfrancis.com International: (Tel) +44 (0) 20 7017 6062; (E-mail) online.sales@tandf.co.uk

Catalysis is a chemical or biological process whereby the presence of an external compound, a catalyst, serves as an agent to cause a chemical reaction to occur or to improve reaction performance without altering the external compound. Catalysis is a very important process from an industrial point of view since the production of most industrially important chemicals involve catalysis. Research into catalysis is a major field in applied science, and involves many fields of chemistry and physics. The new book brings together leading research in this vibrant field.

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...
Supplying nearly 350 expertly-written articles on technologies that can maximize and enhance the research and production phases of current and emerging chemical manufacturing practices and techniques, this second edition provides gold standard articles on the methods, practices, products, and standards recently influencing the chemical industries. New material includes: design of key unit operations involved with chemical processes; design, unit operation, and integration of reactors and separation systems; process system peripherals such as pumps, valves, and controllers; analytical techniques and equipment; current industry practices; and pilot plant design and scale-up criteria.

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, ammonoxidation and hydrofluorination is included. This book incorporates appropriate case studies, explanatory notes, and schematics for more clarity and better understanding.

Abstract: The goal of the chemical industry is to design large-scale industrial chemical processes that are both environmentally benign and economically viable. Building upon the latest advances in green chemistry and sustainability in chemical processes, this dissertation applies a proposed assessment methodology that encourages earlier consideration of emerging and newly developed technologies in the design process. The goal of the assessment methodology is to evaluate the potential of using innovative technologies to achieve profitable alternative chemical processes, while also incorporating sustainability goals in the design thinking. Two case studies were examined using the proposed general assessment methodology. In the first case study, an alternative phosgene-free process to produce polycarbonate using CO2 as raw material was developed and evaluated. The developed polycarbonate process uses alternative intermediates to produce polycarbonate by the transesterification of diphenyl carbonate with bisphenol A and without using phosgene. The second case study addressed the large economic constraint in the conventional methanol synthesis process caused by the equilibrium-limited single-pass conversion, which requires an expensive and energy-intensive synthesis gas recycle loop. To eliminate the recycle loop, an alternative single-pass process using a condensing reactor was proposed and evaluated. The selected reactor technology is capable of condensing methanol as it forms on the catalyst bed, so more gas can be reacted to equilibrium and very high conversion of syngas to methanol is achieved in a single-pass. After-tax discounted cash flow analysis and life cycle assessment (LCA) were used in this study to assess the economic feasibility and the environmental impact of the developed alternative processes. The results showed that, for an annual capacity of 65,000 metric tons polycarbonate, the alternative phosgene-free polycarbonate process is profitable with an NPV of 100.76 million USD, yet it causes 37.2% lower global warming potential and significantly lower human health impact, compared to the conventional phosgene polycarbonate process. The results also showed that the alternative single-pass methanol synthesis process has an incremental DNPV of 78.06 million USD and a 32% reduction in global warming potential compared to the conventional methanol synthesis process. The proposed assessment methodology was applied to develop a complete process using new chemical routes and new process technologies in the first case study. In the second case study, it was applied to improve an established process, by making simple changes that can have large effects on profitability and sustainability. This showed that this assessment methodology applies to disparate types of process designs. Overall, this dissertation showed that the key to achieving a better process design is to increase the design engineer’s access to a variety of process performance metrics, both economic and non-economic. The examination of the two case studies emphasized the importance of incorporating sustainability principles at the early stages of the design process and showed that process sustainability and profitability are not mutually exclusive.

As the field of tribology has evolved, the lubrication industry is also progressing at an extraordinary rate. Updating the author’s bestselling publication, Synthetic Lubricants and High-Performance Functional Fluids, this book features the contributions of over 60 specialists, ten new chapters, and a new title to reflect the evolving nature of the
Carbon Dioxide Utilisation: Closing the Carbon Cycle explores areas of application such as conversion to fuels, mineralization, conversion to polymers, and artificial photosynthesis as well as assesses the potential industrial suitability of the various processes. After an introduction to the thermodynamics, basic reactions, and physical chemistry of carbon dioxide, the book proceeds to examine current commercial and industrial processes, and the potential for carbon dioxide as a green and sustainable resource. While carbon dioxide is generally portrayed as a “bad” gas, a waste product, and a major contributor to global warming, a new branch of science is developing to convert this “bad” gas into useful products. This book explores the science behind converting CO2 into fuels for our cars and planes, and for use in plastics and foams for our homes and cars, pharmaceuticals, building materials, and many more useful products. Carbon dioxide utilization is a rapidly expanding area of research that holds a potential key to sustainable, petrochemical-free chemical production and energy integration. Accessible and balanced between chemistry, engineering, and industrial applications Informed by blue-sky thinking and realistic possibilities for future technology and applications Encompasses supply chain sustainability and economics, processes, and energy integration.

Materials for Biomedical Engineering: Bioactive Materials for Antimicrobial, Anticancer, and Gene Therapy offers an up-to-date perspective on recent research findings regarding the application and use of these materials for disease treatment and prevention. Various types of currently investigated bioactive materials, including therapeutic nanostructures and antimicrobial hydrogels are discussed, as are their properties, impact and future role in therapeutic applications. The book will be extremely useful for new researchers who want to explore more information on the use of bioactive materials or for more experienced researchers who are interested in new trends and specific applications. Provides knowledge on the range of bioactive materials available, enabling the reader to make optimal materials selection decisions Contains detailed information on current and proposed applications of the latest bioactive materials to empower readers to design innovative products and processes Presents a strong emphasis on chemistry and the physico-chemical characterization of these materials and their application in antimicrobial, anticancer and gene therapy.

Volume II contains chapters written by authoritative specialists on the broad spectrum of environmental topics in order to find a way for intense anthropogenic activities to coexist with the natural environment. The book highlights a wide spectrum of themes referring to the environmental analysis and control and molecular modelling of both sorbents and adsorption environmentally-friendly processes. Also covered are new trends in applications of colloidal science for protecting soil systems, purification and production of drinking water, water and groundwater treatment, new environmental adsorbents for removal of pollutants from wastewaters and sewages, selective sorbents for hot combustion gases, some corrosion aspects and ecological adsorption of heating and cooling pumps. The volume concludes with a comprehensive bibliography, which includes the period 1967-1997, on adsorptive separations, environmental applications, PSA, parametric pumping, ion-exchange and chromatography. All articles give both the scientific background of the phenomena discussed and indicate practical aspects.

A guide to the effective catalysts and latest advances in CO2 conversion in chemicals and fuels Carbon dioxide hydrogenation is one of the most promising and economic techniques to utilize CO2 emissions to produce value-added chemicals. With contributions from an international team of experts on the topic, CO2 Hydrogenation Catalysis offers a comprehensive review of the most recent developments in the catalytic hydrogenation of carbon dioxide to formic acid/formate, methanol, methane, and C2+ products. The book explores the electroreduction of carbon dioxide and contains an overview on hydrogen production from formic acid and methanol. With a practical review of the advances and challenges in future CO2 hydrogenation research, the book provides an important guide for researchers in academia and industry working in the field of catalysis, organometallic chemistry, green and sustainable chemistry, as well as energy conversion and storage. This important book: Offers a unique review of effective catalysts and the latest advances in CO2 conversion Explores how to utilize CO2 emissions to produce value-added chemicals and fuels such as methanol, olefins, gasoline, aromatics Includes the latest research in homogeneous and heterogeneous catalysis as well as electrocatalysis Highlights advances and challenges for future investigation Written for chemists, catalytic chemists, electrochemists, chemists in industry, and chemical engineers, CO2 Hydrogenation Catalysis offers a comprehensive resource to understanding how CO2 emissions can create value-added chemicals.
The world's first non-phosgene process for producing an aromatic polycarbonate (PC) using CO2 as a starting material has been succeeded in development and industrialization by Asahi Kasei Corporation, Japan. The new process is not only environmentally friendly, but also economically superior to the current processes. All polycarbonate (PC) in the world have been produced using CO as a starting material until the new process was industrialized in 2002; among them, more than about 90% of polycarbonate (PC) have been produced by the so-called phosgene process. The phosgene process must use not only highly toxic and corrosive phosgene (COCl2) made from CO and Cl2, but also large quantities of solvents, water and methylene chloride which is suspected to be a carcinogen. Furthermore, the phosgene process must execute the disposal treatment of large quantities of wastewater to remove the contaminated organic materials before discharge from the factory. The Asahi Kasei Non-Phosgene Polycarbonate Process enables high-yield production of the two products, high-quality polycarbonate (PC) having excellent properties and high-purity monoethylene glycol (MEG), starting from ethylene oxide (EO), CO2 and bisphenol-A, without waste and wastewater.

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

Copyright code : 851366cde78047fc5f8a506f4b668eb4