Non Phosgene Polycarbonate From Co2 Industrialization Of Green Chemical Process Chemical Engineering Methods And Technology Environmental Remediation Technologies Regulations And Safety

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.

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 fi ne 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.

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.

The first meeting dedicated to the organometallic chemistry in Spain took place during the eighties, when 40 scientists from our country shared their experiences around this genuine discipline. The first GEQO meeting was held in Alcalá de Henares on June 12, 1981. It was decided to continue with this adventure, and only one year later they met again at the Bienal of Chemistry in Santander, in September 1982. Then, in 1983 it was Tarragona's turn to takeover, and convert this Meeting into an exciting experience. Three decades later, and casually during the meeting of the Spanish organometallic group in the Bienal of Santander 2013, we announced that the next GEQO-meeting will take place in Tarragona, between September 17-19, 2014. Despite the changes in the host city and its people, one thing still remains the same: the enthusiasm with which this event is being organized and its projection to everyone who sees in organometallic chemistry… a way of thinking in chemistry.

Carbon Capture and Storage technologies (CCS) are moving from experiment toward commercial applications at a rapid pace, driven by urgent demand for carbon mitigation strategies. This book examines the potential role of CCS from four perspectives: technology development, economic competitiveness, environmental and safety impacts, and social acceptance. IEK-STE of Forschungszentrum Juelich presents this interdisciplinary study on CCS, based on methods of Integrated Technology Assessment. Following an introductory chapter by editor Wilhelm Kuckshinrichs, Part I of the book surveys the status of carbon capture technologies, and assesses the potential for research and development of applications that are useful at scales required for meaningful mitigation. Transportation, Utilization and Environmental Aspects of CO2 receive chapter-length treatments, and the section concludes with an examination of safe geological storage of CO2 based on the example of the Ketzin pilot site, not far from Berlin. Part II covers Economic and Societal Perspectives. The first chapter discusses the use of CCS in the energy sector, analyzing costs associated with electricity generation and CO2 mitigation on the basis of technology-specific cost and process parameters, along with a merit-order illustration of the possible implications of CCS facilities for energy costs. Later chapters outline the costs of CCS application in energy- and CO2-intensive industries; analyze system characteristics of CCS infrastructures, showing that the infrastructure cost function depends on the ratio of fixed to variable costs, as well as on the spatial distribution of CO2 sources and storage facilities; interpret cross-sector carbon mitigation strategies and their impacts on the energy and CO2 balance; and discuss awareness and knowledge of CCS, attitudes towards it, and how the risks and benefits of CCS are perceived. Part III discusses the Framework for Energy and Climate Policy, with chapters on acceptance and adoption of CCS policy in Germany, and the EU, and an assessment of international cooperation in support of CCS. The final chapter summarizes the central arguments, discusses the potential role of carbon capture and utilization as part of a German transformation strategy, and extrapolates the findings to European and international contexts.

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.

Room temperature ionic liquids (RTILs) are an interesting and valuable family of compounds. Although they are all salts, their components can vary considerably, including imidazolium, pyridinium, ammonium, phosphonium, thiazolium, and triazolium cations. In general, these cations have been combined with weakly coordinating anions. Common examples include tetrafluoroborate, hexafluorophosphate, triflate, triflimide, and dicyanimide. The list of possible anionic components continues to grow at a rapid rate. Besides exploring new anionic and cation components, another active and important area of research is the determinination and prediction of their physical properties, particularly since their unusual and tunable properties are so often mentioned as being one of the key advantages of RTILs over conventional solvents. Despite impressive progress, much work remains before the true power of RTILs as designer solvents (i.e. predictable selection of a particular RTIL for any given application) can be effectively harnessed.

For medical devices that must be placed inside the body, the right choice of material is the most important aspect of design. To ensure such devices are safe, reliable, economical, and biologically and physiologically compatible, the modern biomedical engineer must have a broad knowledge of currently available materials and the properties that affe

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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.

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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.

Over the last century,medicine has come out of theblack bag and emerged as one of the most dynamic and advanced fields of development in science and technology. Today, biomedical engineering plays a critical role in patient diagnosis, care, and rehabilitation. As such, the field encompasses a wide range of disciplines, from biology and physiolog

The book comprises state-of-the-art scientific reviews on carbon management strategies in response to climate change. It provides in-depth information on topics relating to recent advances in carbon capture technology and its reuse in value added products. It features contributions of leading scientists and technocrats on topics including climate change and carbon sequestration, lowering carbon footprint CO2 capture, low carbon imperatives in oil industry, CO2 as refrigerant in cold-chain application, carbonic anhydrase-mediated carbon sequestration and utilization, chemical looping combustion with Indian coal, CO2 conversion to chemicals, algae based biofuels, and carbon capture patent landscaping analysis. The contents of this book will be helpful for research scholars, post-graduate students, industry, agricultural scientists and policy makers/planners.

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.

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.

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 understanding the chemistry of sustainable energy, including fossil fuels, thermodynamics, polymers, hydrogen generation and storage, and carbon capture. It offers readers a broad understanding of relevant fundamental chemical principles and in-depth exposure to creative and promising approaches to sustainable energy development.

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.

As we are moving ahead into the 21st century, our hunger for cost effective and environmentally friendly energy continues to grow. The Energy Information Administration of US has forecasted that only in the first two decades of the 21st century, our energy demand will increase by 60% compared to the levels at the end of the 20th century. Fossil fuels have been traditionally the major primary energy sources worldwide, and their role is expected to continue growing for the forecasted period, due to their inherent cost competitiveness compared to non-fossil fuel energy sources. However, the current fossil energy scenario is undergoing significant transformations, especially to accommodate increasingly stringent environmental challenges of contaminants like sulfur dioxide, nitrogen oxides or mercury, while still providing affordable energy. Furthermore, traditional fossil fuel utilization is inherently plagued with greenhouse gas emissions from combustion, especially carbon dioxide from stationary sources as well as from mobile sources. Should worldwide government policies dictate a reduction of greenhouse gas emissions, such as proposed by the Kyoto Protocol and the implementation of carbon taxes, fossil fuels would lose their significant competitive appeal in favor of nuclear energy and renewable energy sources. However, the current non-fossil fuel energy share of the worldwide energy market is merely below 15%, and therefore, it is more likely that fossil fuel energy producers would adapt to the new requirements by developing and implementing emission control technologies, and emission trades among other strategies.

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.

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.

Recent Advances in Science and Technology of Zeolites and Related Materials is a collection of oral and poster communications, presented during the 14th International Zeolite Conference (IZC). The conference was hosted by the Catalysis Society of South Africa. In the tradition of the IZC series, this Conference provides a forum for the presentation of new knowledge in the science and technology of zeolites and related materials. Papers presented cover a wide range of topics that include synthesis, structure determination, characterisation, modelling, and catalysis. This highly visual book is a must for readers looking to stay up-to-date on zeolite science. * This three-part volume provides valuable information on zeolites and related materials * Includes papers that cover topics such as structure determination, modelling and separation processes * Contains new and exciting developments in the field

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.

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.

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 Darensbourg 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.

This book presents chemical analyses of our most pressing waste, pollution, and resource problems for the undergraduate or graduate student. The distinctive holistic approach provides both a solid ground in theory, as well as a laboratory manual detailing introductory and advanced experimental applications. The laboratory procedures are presented at microscale conditions, for minimum waste and maximum economy. This work fulfills an urgent need for an introductory text in environmental chemistry combining theory and practice, and is a valuable tool for preparing the next generation of environmental scientists.

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

Green, sustainable chemistry involves the designing of chemicalprocesses with a view to reducing or even eliminating the use andproduction of hazardous materials. Recent endeavors have focused onlimiting the use of organic solvents and replacing them with new,environmentally benign media. The chemical industry is interestedin these cost-effective, alternative solvents and processes. This book provides a broad overview of the three most commonly usedgreen reaction media. Directed at synthetic organic chemistsworking in academic and industrial laboratories, it will also serveas a textbook for graduate courses on green chemistry. Successfulgreen reactions are considered, and experimental sections at theends of the chapters provide important practical details, withillustrations of potential applications. Sufficient information isincluded to allow selection of the most appropriate medium.Extensively referenced, the volume offers a point of entry into thedetailed literature.

Biomaterials: Principles and Applications offers a comprehensive review of all the major biomaterials in this rapidly growing field. In recent years, the role of biomaterials has been influenced considerably by advances in many areas of biotechnology and science, as well as advances in surgical techniques and instruments. Comprising chapters contributed by a panel of international experts, this text provides a familiarity with the uses of materials in medicine and dentistry and the rational basis for these applications. It covers such subjects as biodegradable polymeric materials and their relation to tissue engineering, biologic materials, and biomaterials applications in soft and hard tissues. Nearly one hundred figures and tables further add to the value of this book. Concise, topical, and not overly technical — no other book covers the entire field of biomaterials so succinctly in one volume.

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.

The Progress and Prosperity of any country mainly depend upon the quality of its human resource,which in turn,depends upon the quality of its educational system.Higher and technical education,being at the apex of the pyramid of education,play a major role in the overall development of any country.One of the major drawbacks of the higher and technical education in our country,is the palpable gap between the world of learning and the world of work.

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.

Aimed at students, lecturers, researchers, and policy makers, this work describes current developments and points the way forward for new developments regarding materials in our society and how they relate to sustainability.

Non-phosgene Polycarbonate from CO2-industrialization of Green Chemical ProcessNova Science Pub Incorporated

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.