

## Gas Liquid Reactions

Chemical Reactor Design Cavitation Reaction Engineering Circular of the University of Illinois Engineering Experiment Station 10th European Conference on Mixing Hydrodynamics of Gas-Liquid Reactors Chemistry of Multiphase Atmospheric Systems Chemical Reaction Engineering and Reactor Technology, Second Edition Elements of Chemical Reaction Engineering Mixing in the Process Industries Mathematical Modelling of Gas-Phase Complex Reaction Systems: Pyrolysis and Combustion Mass Transfer Design of Multiphase Reactors Chemical Reactor Design and Technology Osmotically Driven Membrane Processes Microreactors in Organic Chemistry and Catalysis Chemical Reactor Design An Introduction to Bioreactor Hydrodynamics and Gas-Liquid Mass Transfer Plasma Chemistry and Catalysis in Gases and Liquids Coulson and Richardson's Chemical Engineering Heterogeneous Reactions: Fluid-fluid-solid reactions Catalysis of Organic Reactions Crown Ethers and Phase Transfer Catalysis in Polymer Science Chemical Micro Process Engineering Ozone Reaction Kinetics for Water and Wastewater Systems Carbon Dioxide Chemistry, Capture and Oil Recovery Reaction Engineering Concepts of Chemical Engineering 4 Chemists Perry's Chemical Engineers' Handbook Chemical Reaction and Reactor Engineering Microreactors for Gas/Liquid Reactions Physical Chemistry of Gas-Liquid Interfaces Microstructured Devices for Chemical Processing Chemical Engineering, Volume 3 Micro Process Engineering Chemical Reaction Engineering Gas Treating Inhibition of Chain Reactions Three-phase Catalytic Reactors Chemical Vapor Transport Reactions Mass Transfer with Chemical Reaction

## Chemical Reactor Design

Reviews and compares the major types of bioreactors, defines their pros and cons, and identifies research needs and figures of merit that have yet to be addressed Describes common modes of operation in bioreactors Covers the three common bioreactor types, including stirred-tank bioreactors, bubble column bioreactors, and airlift bioreactors Details less common bioreactors types, including fixed bed bioreactors and novel bioreactor designs Discusses advantages and disadvantages of each bioreactor and provides a procedure for optimal bioreactor selection based on current process needs Reviews the problems of bioreactor selection globally while considering all bioreactor options rather than concentrating on one specific bioreactor type

## Cavitation Reaction Engineering

The publication of the third edition of 'Chemical Engineering Volume 3' marks the completion of the re-orientation of the basic material contained in the first three volumes of the series. Volume 3 is devoted to reaction engineering (both chemical and biochemical), together with measurement and process control. This text is designed for students, graduate

and postgraduate, of chemical engineering.

## **Circular of the University of Illinois Engineering Experiment Station**

Traditionally, fluid mixing and the related multiphase contacting processes have always been regarded as an empirical technology. Many aspects of mixing, dispersing and contacting were related to power draw, but understanding of the phenomena was limited or qualitative at the most. In particular during the last decade, however, plant operation targets have tightened and product specifications have become stricter. The public awareness as to safety and environmental hygiene has increased. The drive towards larger degrees of sustainability in the process industries has urged for lower amounts of solvents and for higher yields and higher selectivities in chemical reactors. All this has resulted in a market pull: the need for more detailed insights in flow phenomena and processes and for better verifiable design and operation methods. Developments in miniaturisation of sensors and circuits as well as in computer technology have rendered leaps possible in computer simulation and animation and in measuring and monitoring techniques. This volume encourages a leap forward in the field of mixing by the current, overwhelming wealth of sophisticated measuring and computational techniques. This leap may be made possible by modern instrumentation, signal and data analysis, field reconstruction algorithms, computational modelling techniques and numerical recipes.

## **10th European Conference on Mixing**

This monograph treats the new and emerging subject of cavitation reaction engineering, specifically, designing the reactor which involves cavitation driven reaction process produced by the hydrodynamic, acoustic or laser forces. The monograph also illustrates the basic treatment of both physics and chemistry associated with the formation, growth and implosion of cavities and the resulting chemical reactions. While a substantial portion of the book reviews the existing literature on cavitation reaction engineering, it also presents some of the authors' views on how to treat the subject from the first principles and what future work is needed to expand knowledge in this area. While cavitation reaction engineering is immediately applicable to water treatment processes, in the near future this process will be important for many applications in chemical, biochemical, petroleum, pharmaceutical and material industries. Apart from introducing the new and emerging subject of reaction engineering, the book illustrates how an introduction of cavitation process can have added value to many existing chemical, biological and catalytic reaction processes. The book should be useful to any student, researcher or industrial designer who is interested in designing and scaling-up cavitation reactor.

## **Hydrodynamics of Gas-Liquid Reactors**

The design of chemical reactors and their safety are as critical to the success of a chemical process as the actual chemistry taking place within the reactor. This book provides a comprehensive overview of the practical aspects of multiphase reactor design and operation with an emphasis on safety and clean technology. It considers not only standard operation conditions, but also the problems of runaway reaction conditions and protection against ensuing over-pressure. Hydrodynamics of Multiphase Reactors addresses both practical and theoretical aspects of this topic. Initial chapters discuss various different types of gas/liquid reactors from a practical viewpoint, and later chapters focus on the modelling of multiphase systems and computational methods for reactor design and problem solving. The material is written by experts in their specific fields and will include chapters on the following topics: Multiphase flow, Bubble columns, Sparged stirred vessels, Macroscale modelling, Microscale modelling, Runaway conditions, Behaviour of vessel contents, Choked flow, Measurement techniques.

### **Chemistry of Multiphase Atmospheric Systems**

This book covers a wide variety of topics related to advancements in different stages of mass transfer modelling processes. Its purpose is to create a platform for the exchange of recent observations, experiences, and achievements. It is recommended for those in the chemical, biotechnological, pharmaceutical, and nanotechnology industries as well as for students of natural sciences, technical, environmental and employees in companies which manufacture machines for the above-mentioned industries. This work can also be a useful source for researchers and engineers dealing with mass transfer and related issues.

### **Chemical Reaction Engineering and Reactor Technology, Second Edition**

This work presents a compilation of technical papers and poster synopses delivered at the 14th Conference on Catalysis of Organic Reactions. The book investigates current developments in the study of catalysis as it relates to organic synthesis, detailing industrial applications. It suggests cost-effective routes for the synthesis of valuable industrial and pharmaceutical chemicals.

### **Elements of Chemical Reaction Engineering**

### **Mixing in the Process Industries**

Faster, cheaper and environmentally friendly, these are the criteria for designing new reactions and this is the challenge faced by many chemical engineers today. Based on courses taught by the authors, this advanced textbook discusses

opportunities for carrying out reactions on an industrial level in a technically controllable, sustainable, cost-effective and safe manner. Adopting a practical approach, it describes how miniaturized devices (mixers, reactors, heat exchangers, and separators) are used successfully for process intensification, focusing on the engineering aspects of microstructured devices, such as their design and main characteristics for homogeneous and multiphase reactions. It addresses the conditions under which microstructured devices are beneficial, how they should be designed, and how such devices can be integrated in an existing chemical process. Case studies show how the knowledge gained can be applied for particular processes. The textbook is essential for master and doctoral students, as well as for professional chemists and chemical engineers working in this area.

### **Mathematical Modelling of Gas-Phase Complex Reaction Systems: Pyrolysis and Combustion**

Fossil fuels still need to meet the growing demand of global economic development, yet they are often considered as one of the main sources of the CO<sub>2</sub> release in the atmosphere. CO<sub>2</sub>, which is the primary greenhouse gas (GHG), is periodically exchanged among the land surface, ocean, and atmosphere where various creatures absorb and produce it daily. However, the balanced processes of producing and consuming the CO<sub>2</sub> by nature are unfortunately faced by the anthropogenic release of CO<sub>2</sub>. Decreasing the emissions of these greenhouse gases is becoming more urgent. Therefore, carbon sequestration and storage (CSS) of CO<sub>2</sub>, its utilization in oil recovery, as well as its conversion into fuels and chemicals emerge as active options and potential strategies to mitigate CO<sub>2</sub> emissions and climate change, energy crises, and challenges in the storage of energy.

### **Mass Transfer**

This comprehensive handbook covers the diverse aspects of chemical vapor transport reactions from basic research to important practical applications. The book begins with an overview of models for chemical vapor transport reactions and then proceeds to treat the specific chemical transport reactions for the elements, halides, oxides, sulfides, selenides, tellurides, pnictides, among others. Aspects of transport from intermetallic phases, the stability of gas particles, thermodynamic data, modeling software and laboratory techniques are also covered. Selected experiments using chemical vapor transport reactions round out the work, making this book a useful reference for researchers and instructors in solid state and inorganic chemistry.

### **Design of Multiphase Reactors**

This book presents an authoritative progress report that will remain germane to the topic and prove to be a substantial

inspiration to further progress. It is valuable to academic and industrial practitioners of the art and science of chemical reaction and reactor engineering.

## **Chemical Reactor Design and Technology**

Filling the gap for a book that covers not only plasma in gases but also in liquids, this is all set to become the standard reference for this topic. It provides a broad-based overview of plasma-chemical and plasmacatalytic processes generated by electrical discharges in gases, liquids and gas/liquid environments in both fundamental and applied aspects by focusing on their environmental and green applications and also taking into account their practical and economic viability. With the topics addressed by an international group of major experts, this is a must-have for scientists, engineers, students and postdoctoral researchers specializing in this field.

## **Osmotically Driven Membrane Processes**

Filling a longstanding gap for graduate courses in the field, Chemical Reaction Engineering: Beyond the Fundamentals covers basic concepts as well as complexities of chemical reaction engineering, including novel techniques for process intensification. The book is divided into three parts: Fundamentals Revisited, Building on Fundamentals, and Beyond

## **Microreactors in Organic Chemistry and Catalysis**

The role of the chemical reactor is crucial for the industrial conversion of raw materials into products and numerous factors must be considered when selecting an appropriate and efficient chemical reactor. Chemical Reaction Engineering and Reactor Technology defines the qualitative aspects that affect the selection of an industrial chemical reactor and couples various reactor models to case-specific kinetic expressions for chemical processes. Thoroughly revised and updated, this much-anticipated Second Edition addresses the rapid academic and industrial development of chemical reaction engineering. Offering a systematic development of the chemical reaction engineering concept, this volume explores: essential stoichiometric, kinetic, and thermodynamic terms needed in the analysis of chemical reactors homogeneous and heterogeneous reactors reactor optimization aspects residence time distributions and non-ideal flow conditions in industrial reactors solutions of algebraic and ordinary differential equation systems gas- and liquid-phase diffusion coefficients and gas-film coefficients correlations for gas-liquid systems solubilities of gases in liquids guidelines for laboratory reactors and the estimation of kinetic parameters The authors pay special attention to the exact formulations and derivations of mass energy balances and their numerical solutions. Richly illustrated and containing exercises and solutions covering a number of processes, from oil refining to the development of specialty and fine chemicals, the text provides a clear understanding

of chemical reactor analysis and design.

### **Chemical Reactor Design**

Reaction Engineering clearly and concisely covers the concepts and models of reaction engineering and then applies them to real-world reactor design. The book emphasizes that the foundation of reaction engineering requires the use of kinetics and transport knowledge to explain and analyze reactor behaviors. The authors use readily understandable language to cover the subject, leaving readers with a comprehensive guide on how to understand, analyze, and make decisions related to improving chemical reactions and chemical reactor design. Worked examples, and over 20 exercises at the end of each chapter, provide opportunities for readers to practice solving problems related to the content covered in the book. Seamlessly integrates chemical kinetics, reaction engineering, and reactor analysis to provide the foundation for optimizing reactions and reactor design Compares and contrasts three types of ideal reactors, then applies reaction engineering principles to real reactor design Covers advanced topics, like microreactors, reactive distillation, membrane reactors, and fuel cells, providing the reader with a broader appreciation of the applications of reaction engineering principles and methods

### **An Introduction to Bioreactor Hydrodynamics and Gas-Liquid Mass Transfer**

A guide to the technical and calculation problems of chemical reactor analysis, scale-up, catalytic and biochemical reactor design Chemical Reactor Design offers a guide to the myriad aspects of reactor design including the use of numerical methods for solving engineering problems. The author - a noted expert on the topic - explores the use of transfer functions to study residence time distributions, convolution and deconvolution curves for reactor characterization, forced-unsteady-state-operation, scale-up of chemical reactors, industrial catalysis, design of multiphase reactors, biochemical reactors design, as well as the design of multiphase gas-liquid-solid reactors. Chemical Reactor Design contains several examples of calculations and it gives special emphasis on the numerical solutions of differential equations by using the finite differences approximation, which offers the background information for understanding other more complex methods. The book is designed for the chemical engineering academic community and includes case studies on mathematical modeling by using of MatLab software. This important book: - Offers an up-to-date insight into the most important developments in the field of chemical, catalytic, and biochemical reactor engineering - Contains new aspects such as the use of numerical methods for solving engineering problems, transfer functions to study residence time distributions, and more - Includes illustrative case studies on MatLab approach, with emphasis on numerical solution of differential equations using the finite differences approximation Written for chemical engineers, mechanical engineers, chemists in industry, complex chemists, bioengineers, and process engineers, Chemical Reactor Design addresses the technical and calculation problems of

chemical reactor analysis, scale-up, as well as catalytic and biochemical reactor design.

## **Plasma Chemistry and Catalysis in Gases and Liquids**

The Platinum Edition presents the complete content of Perry's Chemical Engineer's Handbook, Seventh Edition, in both print and electronic formats packaged together and now available at one great price. The print Handbook is the world renowned source to chemical engineering practices--covering everything from the fundamentals to details on computer applications and control, as well as the newest advances in your field. The accompanying CD, with its extensive graphics and fast problem-solving capabilities, is the perfect interactive complement to the text. This exclusive set is expressively designed for engineers with the highest standards--professionals who will settle for nothing less than the outstanding, superior-quality reference tools in this Platinum Edition. Two great reference tools--available at one great price! On the CD-ROM \*The entire text of Perry's Chemical Handbook, Seventh Edition \*75 interactive equations \*On-screen problem-solving: math formulas, calculations, graphs, and tables \*Automatic conversions from U.S. to metric (SI) standard units \*Fully searchable Adobe Acrobat format \*Hyperlinked Table of Contents and Index Minimum System Requirements PC with 486 or higher processor Microsoft Windows 3.1, Windows 95, or Windows NT 3.5.1 or later / 16 MB of RAM 25 MB of available hard-disk space SVGA monitor / 2x CD-ROM drive / Mouse

## **Coulson and Richardson's Chemical Engineering**

This volume is a valuable reference work for the student and the practising engineer in the chemical, pharmaceutical, minerals, food, plastics, paper and metallurgical industries. The second edition of this successful text has been thoroughly rewritten and updated. Based on the long running post-experience course produced by the University of Bradford, in association with the Institution of Chemical Engineers, it covers all aspects of mixing, from fundamentals through to design procedures in single and multi-phase systems. Experts from both industry and academia have contributed to this work giving both a theoretical practical approach. It covers dry and wet powders, single and two-phase liquids, solid/liquid and gas/liquid systems. The range of mixers available for such diverse duties is dealt with, including tumbler mixers for powders, mechanically agitated vessels, in-line continuous mixers and jet mixers. Coverage is given of the range of mixing objectives, varying from achieving product uniformity to obtaining optimum conditions for mass transfer and chemical reactions. This volume is a valuable reference work for the student and the practising engineer in the chemical, pharmaceutical, minerals, food, plastics, paper and metallurgical industries. The second edition of this successful text has been thoroughly rewritten and updated. Based on the long running post-experience course produced by the University of Bradford, in association with the Institution of Chemical Engineers, it covers all aspects of mixing, from fundamentals through to design procedures in single and multi-phase systems. Experts from both industry and academia have

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### **Heterogeneous Reactions: Fluid-fluid-solid reactions**

Osmotically driven membrane processes (ODMPs) including forward osmosis (FO) and pressure-retarded osmosis (PRO) have attracted increasing attention in fields such as water treatment, desalination, power generation, and life science. In contrast to pressure-driven membrane processes, e.g., reverse osmosis, which typically employs applied high pressure as driving force, ODMPs take advantages of naturally generated osmotic pressure as the sole source of driving force. In light of this, ODMPs possess many advantages over pressure-driven membrane processes. The advantages include low energy consumption, ease of equipment maintenance, low capital investment, high salt rejection, and high water flux. In the past decade, over 300 academic papers on ODMPs have been published in a variety of application fields. The number of such publications is still rapidly growing. The ODMPs' approach, fabrications, recent development and applications in wastewater treatment, power generation, seawater desalination, and gas absorption are presented in this book.

### **Catalysis of Organic Reactions**

### **Crown Ethers and Phase Transfer Catalysis in Polymer Science**

Gas Treating: Absorption Theory and Practice provides an introduction to the treatment of natural gas, synthesis gas and flue gas, addressing why it is necessary and the challenges involved. The book concentrates in particular on the absorption-desorption process and mass transfer coupled with chemical reaction. Following a general introduction to gas treatment, the chemistry of CO<sub>2</sub>, H<sub>2</sub>S and amine systems is described, and selected topics from physical chemistry with relevance to gas treating are presented. Thereafter the absorption process is discussed in detail, column hardware is explained and the traditional mass transfer model mechanisms are presented together with mass transfer correlations. This is followed by the central point of the text in which mass transfer is combined with chemical reaction, highlighting the associated possibilities and problems. Experimental techniques, data analysis and modelling are covered, and the book concludes with a discussion on various process elements which are important in the absorption-desorption process, but are often neglected in its treatment. These include heat exchange, solution management, process flowsheet variations, choice of

materials and degradation of absorbents. The text is rounded off with an overview of the current state of research in this field and a discussion of real-world applications. This book is a practical introduction to gas treating for practicing process engineers and chemical engineers working on purification technologies and gas treatment, in particular, those working on CO<sub>2</sub> abatement processes, as well as post-graduate students in process engineering, chemical engineering and chemistry.

### **Chemical Micro Process Engineering**

Based on the popular course of the same title, *Concepts of Chemical Engineering 4 Chemists* outlines the basic aspects of chemical engineering for chemistry professionals. It clarifies the terminology used and explains the systems methodology approach to process design and operation for chemists with limited chemical engineering knowledge. The book provides practical insights into all areas of chemical engineering, including such aspects as pump design and the measurement of key process variables. The calculation of design parameters, such as heat and mass transfer coefficients, and reaction scale-up are also discussed, as well as hazard analysis, project economics and process control. Designed as a reference guide, it is fully illustrated and includes worked examples as well as extensive reference and bibliography sections. *Concepts of Chemical Engineering 4 Chemists* is ideal for those who either work alongside chemical engineers or who are embarking on chemical engineering-type projects.

### **Ozone Reaction Kinetics for Water and Wastewater Systems**

This text explores nonbranching reactions, including in-depth information on the inhibitors of free radical polymerisation and the mechanisms of antioxidants on oxidation processes. Auto-initiated chain reactions are also explored, with detailed descriptions on the kinetics, mechanisms, and inhibition of the autoxidation of organic compounds. A special chapter deals with the synergism of antioxidant actions. The theory of chain-branching reactions is investigated, and a large amount of new experimental data concerning the use of chemical additives to regulate combustion processes is also presented, including the mode of chain thermal explosion.

### **Carbon Dioxide Chemistry, Capture and Oil Recovery**

### **Reaction Engineering**

Rapidly increasing interest in the problems of air pollution and source-receptor relationships has led to a significant expansion of knowledge in the field of atmospheric chemistry. In general the chemistry of atmospheric trace constituents is

governed by the oxygen content of the atmosphere. Upon entering the atmosphere in a more or less reduced state, trace substances are oxidized via various pathways and the generated products are often precursors of acidic compounds. Beside oxidation processes occurring in the gas phase, gaseous compounds are often converted into solid aerosol particles. The various steps within gas-to-particle conversion are constantly interacting with condensation processes, which are caused by the tropospheric water content. Thus in addition to the gaseous state, a liquid and solid state exists within the troposphere. The solid phase consists of atmospheric conversion products or fly ash and mineral dust. The liquid phase consists of water, conversion products and soluble compounds. The chemistry occurring within this system is often referred to as homogeneous chemistry. The chemist interprets this term, however, more strictly as reactions which occur only at an interphase between phases. This, however, is not always what happens in the atmosphere. There are indeed heterogeneous processes such as reactions occurring on the surface of dry aerosol particles. But apart from these, we must focus as well on reactions in the homogeneous phase, which are single steps of consecutive reactions running through various phases.

### **Concepts of Chemical Engineering 4 Chemists**

Physical Chemistry of Gas-Liquid Interfaces, the first volume in the Developments in Physical & Theoretical Chemistry series, addresses the physical chemistry of gas transport and reactions across liquid surfaces. Gas-liquid interfaces are all around us, especially within atmospheric systems such as sea spray aerosols, cloud droplets, and the surface of the ocean. Because the reaction environment at liquid surfaces is completely unlike bulk gas or bulk liquid, chemists must readjust their conceptual framework when entering this field. This book provides the necessary background in thermodynamics and computational and experimental techniques for scientists to obtain a thorough understanding of the physical chemistry of liquid surfaces in complex, real-world environments. Provides an interdisciplinary view of the chemical dynamics of liquid surfaces, making the content of specific use to physical chemists and atmospheric scientists Features 100 figures and illustrations to underscore key concepts and aid in retention for young scientists in industry and graduate students in the classroom Helps scientists who are transitioning to this field by offering the appropriate thermodynamic background and surveying the current state of research

### **Perry's Chemical Engineers' Handbook**

Coulson and Richardson's Chemical Engineering: Volume 3A: Chemical and Biochemical Reactors and Reaction Engineering, Fourth Edition, covers reactor design, flow modelling, gas-liquid and gas-solid reactions and reactors. Captures content converted from textbooks into fully revised reference material Includes content ranging from foundational through technical Features emerging applications, numerical methods and computational tools

## **Chemical Reaction and Reactor Engineering**

Interest in ozonation for drinking water and wastewater treatment has soared in recent years due to ozone's potency as a disinfectant, and the increasing need to control disinfection byproducts that arise from the chlorination of water and wastewater. Ozone Reaction Kinetics for Water and Wastewater Systems is a comprehensive reference that

## **Microreactors for Gas/Liquid Reactions**

Today's frustrations and anxieties resulting from two energy crises in only one decade, show us the problems and fragility of a world built on high energy consumption, accustomed to the use of cheap non-renewable energy and to the acceptance of existing imbalances between the resources and demands of countries. Despite all these stressing factors, our world is still hesitating about the urgency of undertaking new and decisive research that could stabilize our future, Could this trend change in the near future? In our view, two different scenarios are possible. A renewed energy tension could take place with an unpredictable timing mostly related to political and economic factors, This could bring again scientists and technologists to a new state of shock and awaken our talents, A second interesting and beneficial scenario could result from the positive influence of a new generation of researchers that with or without immediate crisis, acting both in industry and academia, will face the challenge of developing technologies and processes to pave the way to a less vulnerable society, Because Chemical Reactor Design and Technology activities are at the heart of these required new technologies the timeliness of the NATO-Advanced Study Institute at the University of Western Ontario, London, was very appropriate.

## **Physical Chemistry of Gas-Liquid Interfaces**

This three-volume handbook provides an overview of the key aspects of micro process engineering. Volume 1 covers the fundamentals, operations and catalysts, volume 2 examines devices, reactions and applications, with volume 3 rounding off the trilogy with system, process and plant engineering. Fluid dynamics, mixing, heat/mass transfer, purification and separation microstructured devices and microstructured reactors are explained in the first volume. Volume 2 segments microreactor design, fabrication and assembly, bulk and fine chemistry, polymerisation, fuel processing and functional materials into understandable parts. The final volume of the handbook addresses microreactor systems design and scale-up, sensing, analysis and control, chemical process engineering, economic and eco-efficiency analyses as well as microreactor plant case studies in one book. Together, this 3-volume handbook explains the science behind micro process engineering to the scale-up and their real life industrial applications.

## **Microstructured Devices for Chemical Processing**

Nothing provided

## **Chemical Engineering, Volume 3**

"This resource offers a primer on simple design methods for multiphase reactors in the chemical process industries, particularly the fine chemicals industry. It provides the process design engineer with simple yet theoretically sound procedures. Different types of multiphase reactors are dealt with on an individual basis. The book focuses on the problem of predicting mass transfer rates in these reactors. It also contains finally worked examples that clearly illustrate how a highly complex MPR like the Stirred Tank Reactor (STR) can be designed using simple correlations which need only a scientific calculator"--

## **Micro Process Engineering**

Micro process engineering is approaching both academia and industry. With the provision of micro devices, systems and whole plants by commercial suppliers, one main barrier for using these units has been eliminated. This book focuses on processes and their plants rather than on devices: what is 'before', 'behind' and 'around' micro device fabrication - and gives a comprehensive and detailed overview on the micro-reactor plants and three topic-class applications which are mixing, fuel processing, and catalyst screening. Thus, the book reflects the current level of development from 'micro-reactor design' to 'micro-reactor process design'.

## **Chemical Reaction Engineering**

Phase transfer catalysis or interfacial catalysis is a synthetic technique involving transport of an organic or inorganic salt from a solid or aqueous phase into an organic liquid where reaction with an organic-soluble substrate takes place. Over the past 15 years there has been an enormous amount of effort invested in the development of this technique in organic synthesis. Several books and numerous review articles have appeared summarizing applications in which low molecular weight catalysts are employed. These generally include either crown ethers or onium salts of various kinds. While the term phase transfer catalysis is relatively new, the concept of using a phase transfer agent (PTA) is much older~ Both Schnell and Morgan employed such catalysts in synthesis of polymeric species in the early 1950's. Present developments are really extensions of these early applications. It has only been within the last several years that the use of phase transfer processes have been employed in polymer synthesis and modification. Similarly, the use of polymer-bound phase transfer agents is also a recent development. These and related areas have nonetheless enjoyed explosive growth as measured by the number of publications and the variety of applications which have appeared. Several reviews dealing with these I 6

polymer-related investigations have been published.

### **Gas Treating**

Mathematical Modelling of Gas-Phase Complex Reaction Systems: Pyrolysis and Combustion, Volume 45, gives an overview of the different steps involved in the development and application of detailed kinetic mechanisms, mainly relating to pyrolysis and combustion processes. The book is divided into two parts that cover the chemistry and kinetic models and then the numerical and statistical methods. It offers a comprehensive coverage of the theory and tools needed, along with the steps necessary for practical and industrial applications. Details thermochemical properties and "ab initio" calculations of elementary reaction rates Details kinetic mechanisms of pyrolysis and combustion processes Explains experimental data for improving reaction models and for kinetic mechanisms assessment Describes surrogate fuels and molecular reconstruction of hydrocarbon liquid mixtures Describes pollutant formation in combustion systems Solves and validates the kinetic mechanisms using numerical and statistical methods Outlines optimal design of industrial burners and optimization and dynamic control of pyrolysis furnaces Outlines large eddy simulation of turbulent reacting flows

### **Inhibition of Chain Reactions**

For the second edition of 'Microreactors in Organic Chemistry and Catalysis' all chapters have been revised and updated to reflect the latest developments in this rapidly developing field. This new edition has 60% more content, and it remains a comprehensive publication covering most aspects of the topic. The use of microreactors in homogeneous, heterogeneous as well as biphasic reactions is covered in the main part of the book, together with catalytic, bioorganic and automation approaches. The initial chapters also provide a solid physical chemistry background on fluidics in microdevices. Finally, a chapter on industrial applications and developments covers recent progress in process chemistry. An excellent reference for beginners and experts alike.

### **Three-phase Catalytic Reactors**

Featuring case studies and worked examples that illustrate key concepts in the text, this book contains guidelines for scaleup of laboratory and pilot plant results, methods to derive the correct reaction order, activation energy, or kinetic model from laboratory tests, and theories, correlations, and practical examples for 2- and 3-phase reaction

### **Chemical Vapor Transport Reactions**

## **Mass Transfer with Chemical Reaction**

The book presents in a clear and concise manner the fundamentals of chemical reaction engineering. The structure of the book allows the student to solve reaction engineering problems through reasoning rather than through memorization and recall of numerous equations, restrictions, and conditions under which each equation applies. The fourth edition contains more industrial chemistry with real reactors and real engineering and extends the wide range of applications to which chemical reaction engineering principles can be applied (i.e., cobra bites, medications, ecological engineering)

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