

Process Intensification Engineering For Efficiency Sustainability And Flexibility Isotopes In Organic Chemistry

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Re-Engineering the Chemical Processing Plant - Andrzej Stankiewicz 2018-12-14

The first guide to compile current research and frontline developments in the science of process intensification (PI), *Re-Engineering the Chemical Processing Plant* illustrates the design, integration, and application of PI principles and structures for the development and optimization of chemical and industrial plants. This volume updates professionals on emerging PI equipment and methodologies to promote technological advances and operational efficacy in chemical, biochemical, and engineering environments and presents clear examples illustrating the implementation and application of specific process-intensifying equipment and methods in various commercial arenas.

Process Synthesis and Process Intensification - Ben-Guang Rong 2017-09-25

Process synthesis and process intensification are becoming state-of-the-art scientific fields that provide the methods and tools to improve process technologies in terms of high energy efficiency, low capital investment, low emissions, improved safety, and less hazardous byproducts to achieve sustainable products and processes. The book covers manufacturing processes from both fossil- and biomass-based feedstocks for graduate students.

Process Plants - 2010-05-17

How far will an ounce of prevention really go? While the answer to that question may never be truly known, *Process Plants: A Handbook for Inherently Safer Design, Second Edition* takes us several steps closer. The book demonstrates not just the importance of prevention, but the importance of designing with prevention in mind. It emphasizes the role

Process Design, Integration, and Intensification - Mahmoud El-Halwagi 2019

With the growing emphasis on enhancing the sustainability and efficiency of industrial plants, process integration and intensification are gaining additional interest throughout the chemical engineering community. Some of the hallmarks of process integration and intensification include a holistic perspective in design, and the enhancement of material and energy intensity. The techniques are applicable for individual unit operations, multiple units, a whole industrial facility, or even a cluster of industrial plants. This book aims to cover recent advances in the development and application of process integration and intensification. Specific applications are reported for hydraulic fracturing, palm oil milling processes, desalination, reactive distillation, reaction network, adsorption processes, herbal medicine extraction, as well as process control.

Novel Concepts in Catalysis and Chemical Reactors - Andrzej Cybulski 2011-08-04

The chemical process industry faces a tremendous challenge of supplying a growing and ever more demanding global population with the products we need. The average efficiency at which resources are converted into the final products is however still dramatically low. The most obvious solution is to carry out chemical conversions at much higher yields and selectivity and this is where active and selective catalysts and efficient chemical reactors play a crucial role. Written by an international team of highly experienced editors and authors from academia and industry, this ready reference focuses on how to enhance the efficiency of catalysts and reactors. It treats key topics such as molecular modeling, zeolites, MOFs, catalysis

at room temperature, biocatalysis, catalysis for sustainability, structured reactors including membrane and microchannel reactors, switching from batch to continuous reactors, application of alternative energies and process intensification. By including recent achievements and trends, the book provides an up-to-date insight into the most important developments in the field of industrial catalysis and chemical reactor engineering. In addition, several ways of improving efficiency, selectivity, activity and improved methods for scale-up, modeling and design are presented in a compact manner.

Sustainable Membrane Technology for Water and Wastewater Treatment - Alberto Figoli 2017-09-19

This book analyses the sustainability of membrane operations applied on an industrial scale, as well as that of those under investigation on lab/pilot scales, covering also the preparation of both polymeric and inorganic membranes. It presents reverse osmosis in desalination, membrane bioreactors for municipal wastewater treatment and pressure-driven industrial wastewater treatment in agrofood and textile fields as examples of industrial membrane operations. Regarding the membrane processes still on a lab/pilot scale, the analysis includes membrane operations for the recovery of valuable products from wastewater streams, for the removal of toxic compounds from water/wastewater, and for zero liquid discharge approaches in desalination. The book offers a useful guide for scientists and engineers working in various fields, including membrane technology, separation, desalination, and wastewater treatment. Alberto Figoli and Alessandra Criscuoli are both Senior Researchers at the Institute on Membrane Technology (ITM-CNR), Italy.

Improvements in Bio-Based Building Blocks Production Through Process Intensification and Sustainability Concepts - Juan Gabriel Segovia-Hernandez 2021-10-01

Improvements in Bio-Based Building Blocks Production Through Process Intensification and Sustainability Concepts discusses new information on the production and cost of bio-based building blocks. From a technical point-of-view, almost all industrial materials made from fossil resources can be substituted using bio-based counterparts. However, the cost of bio-based production in many cases exceeds the cost of petrochemical production. In addition, new products must be proven to perform at least as good as their petrochemical equivalents, have a lower environmental impact, meet consumer demand for environmentally-friendly products, factor in population growth, and account for limited supplies of non-renewables. This book outlines the application of process intensification techniques which allow for the generation of clean, efficient and economical processes for bio-based chemical blocks production. Includes synthesis and process design strategies for intensified processes Describes multi-objective optimization applied to the production of bio-based building blocks Presents the controllability of processes where the production of bio-based building blocks is involved Provides examples using aspen and MATLAB Introduces several sustainable indexes to evaluate production processes Presents process intensification techniques to improve performance in productive processes

Process Intensification Technologies for Biodiesel Production - Anton Alexandru Kiss 2014-03-15

This book is among the first to address the novel process intensification technologies for biodiesel production, in particular the integrated reactive separations. It provides a comprehensive overview

illustrated with many industrially relevant examples of novel reactive separation processes used in the production of biodiesel (e.g. fatty acid alkyl esters): reactive distillation, reactive absorption, reactive extraction, membrane reactors, and centrifugal contact separators. Readers will also learn about the working principles, design and control of integrated processes, while also getting a relevant and modern overview of the process intensification opportunities for biodiesel synthesis. Biodiesel is a biodegradable and renewable fuel that currently enjoys much attention. In spite of the recent advances, the existing biodiesel processes still suffer from problems associated with the use of homogeneous catalysts (e.g. salt waste streams) and the key limitations imposed by the chemical reaction equilibrium, thus leading to severe economic and environmental penalties. The integration of reaction and separation into one operating unit overcomes equilibrium limitations and provides key benefits such as low capital investment and operating costs. Many of these processes can be further enhanced by heat-integration and powered by heterogeneous catalysts, to eliminate all conventional catalyst related operations, using the raw materials efficiently and the reaction volume, while offering high conversion and selectivity, and significant energy savings. The targeted audience of this book includes both academia (students and researchers) and industry (project leaders, technology managers, researchers, biodiesel producers, and equipment suppliers).

Process Intensification for Sustainable Energy Conversion - Fausto Gallucci 2015-07-07

This book addresses the application of process intensification to sustainable energy production, combining two very topical subject areas. Due to the increasing process of petroleum, sustainable energy production technologies must be developed, for example bioenergy, blue energy, chemical looping combustion, concepts for CO₂ capture etc. Process intensification offers significant competitive advantages, because it provides more efficient processes, leading to outstanding cost reduction, increased productivity and more environment-friendly processes.

Process Intensification - David Reay 2011-04-08

Process intensification (PI) is a chemical and process design approach that leads to substantially smaller, cleaner, safer and more energy-efficient process technology. A hot topic across the chemical and process industries, this is the first book to provide a practical working guide to understanding and developing successful PI solutions that deliver savings and efficiencies. It will appeal to engineers working with leading-edge process technologies and those involved research and development of chemical, process, environmental, pharmaceutical, and bioscience systems. * Shows chemical and process engineers how to apply process intensification to their system, process or operation * A hard-working reference and user guide to the technology AND application of PI, covering fundamentals, industry applications, supplemented by a development and implementation guide * Leading author team, including Professor Colin Ramshaw, developer of the HiGee high-gravity distillation process at ICI, widely credited as the instigator of PI principles

Process Intensification and Integration for Sustainable Design - Dominic C. Y. Foo 2021-04-19

Presents comprehensive coverage of process intensification and integration for sustainable design, along with fundamental techniques and experiences from the industry Drawing from fundamental techniques and recent industrial experiences, this book discusses the many developments in process intensification and integration and focuses on increasing sustainability via several overarching topics such as Sustainable Manufacturing, Energy Saving Technologies, and Resource Conservation and Pollution Prevention Techniques. Process Intensification and Integration for Sustainable Design starts discussions on: shale gas as an option for the production of chemicals and challenges for process intensification; the design and techno-economic analysis of separation units to handle feedstock variability in shale gas treatment; RO-PRO desalination; and techno-economic and environmental assessment of ultrathin polysulfone membranes for oxygen-enriched combustion. Next, it looks at process intensification of membrane-based systems for water, energy, and environment applications; the design of internally heat-integrated distillation column (HIDiC); and graphical analysis and integration of heat exchanger networks with heat pumps. Decomposition and implementation of large-scale interplant heat integration is covered, as is the synthesis of combined heat and mass exchange networks (CHAMENs) with renewables. The book also covers optimization strategies for integrating and intensifying housing complexes; a sustainable biomass conversion process assessment; and more. Covers the many advances and changes in process intensification and integration Provides side-by-side discussions of fundamental techniques and recent industrial experiences to guide practitioners in their

own processes Presents comprehensive coverage of topics relevant, among others, to the process industry, biorefineries, and plant energy management Offers insightful analysis and integration of reactor and heat exchanger network Looks at optimization of integrated water and multi-regenerator membrane systems involving multi-contaminants Process Intensification and Integration for Sustainable Design is an ideal book for process engineers, chemical engineers, engineering scientists, engineering consultants, and chemists. *The Water-Food-Energy Nexus* - I. M. Mujtaba 2017-09-11

Exponential growth of the worldwide population requires increasing amounts of water, food, and energy. However, as the quantity of available fresh water and energy sources directly affecting cost of food production and transportation diminishes, technological solutions are necessary to secure sustainable supplies. In direct response to this reality, this book focuses on the water-energy-food nexus and describes in depth the challenges and processes involved in efficient water and energy production and management, wastewater treatment, and impact upon food and essential commodities. The book is organized into 4 sections on water, food, energy, and the future of sustainability, highlighting the interplay among these topics. The first section emphasizes water desalination, water management, and wastewater treatment. The second section discusses cereal processing, sustainable food security, bioenergy in food production, water and energy consumption in food processing, and mathematical modeling for food undergoing phase changes. The third section discusses fossil fuels, biofuels, synthetic fuels, renewable energy, and carbon capture. Finally, the book concludes with a discussion of the future of sustainability, including coverage of the role of molecular thermodynamics in developing processes and products, green engineering in process systems, petrochemical water splitting, petrochemical approaches to solar hydrogen generation, design and operation strategy of energy-efficient processes, and the sustainability of process, supply chain, and enterprise.

Chemical Process Retrofitting and Revamping - Gade Pandu Rangaiah 2016-01-22

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.

Extrusion Processing Technology - Jean-Marie Bouvier 2014-06-23

Extrusion is the operation of forming and shaping a molten or dough-like material by forcing it through a restriction, or die. It is applied and used in many batch and continuous processes. However, extrusion processing technology relies more on continuous process operations which use screw extruders to handle many process functions such as the transport and compression of particulate components, melting of polymers, mixing of viscous media, heat processing of polymeric and biopolymeric materials, product texturization and shaping, defibering and chemical impregnation of fibrous materials, reactive extrusion, and fractionation of solid-liquid systems. Extrusion processing technology is highly complex, and in-depth descriptions and discussions are required in order to provide a complete understanding and analysis of this area: this book aims to provide readers with these analyses and discussions. *Extrusion Processing Technology: Food and Non-Food Biomaterials* provides an overview of extrusion processing technology and its established and emerging industrial applications. Potency of process intensification and sustainable processing is also discussed and illustrated. The book aims to span the gap between the principles of extrusion science and the practical knowledge of operational engineers and technicians. The authors bring their research and industrial experience in extrusion processing technology to provide a comprehensive, technical yet readable volume that will appeal to readers from both academic and practical backgrounds. This book is primarily aimed at scientists and engineers engaged in industry, research, and teaching activities related to the extrusion processing of foods (especially cereals, snacks, textured and fibrated proteins, functional ingredients, and instant powders), feeds (especially aquafeeds and petfoods), bioplastics and plastics, biosourced chemicals, paper pulp, and biofuels. It will also be of interest to students of food science, food engineering, and chemical engineering. Also available *Formulation Engineering of Foods* Edited by J.E. Norton, P.J. Fryer and I.T. Norton ISBN 978-0-470-67290-7 *Food and Industrial Bioproducts* and

Bioprocessing Edited by N.T. Dunford ISBN 978-0-8138-2105-4 Handbook of Food Process Design Edited by J. Ahmed and M.S. Rahman ISBN 978-1-4443-3011-3

Process Design, Integration, and Intensification - Mahmoud El-Halwagi 2019-05-27

With the growing emphasis on enhancing the sustainability and efficiency of industrial plants, process integration and intensification are gaining additional interest throughout the chemical engineering community. Some of the hallmarks of process integration and intensification include a holistic perspective in design, and the enhancement of material and energy intensity. The techniques are applicable for individual unit operations, multiple units, a whole industrial facility, or even a cluster of industrial plants. This book aims to cover recent advances in the development and application of process integration and intensification.

Specific applications are reported for hydraulic fracturing, palm oil milling processes, desalination, reactive distillation, reaction network, adsorption processes, herbal medicine extraction, as well as process control.

Sustainable Development in Chemical Engineering - Vincenzo Piemonte 2013-05-28

Sustainable development is an area that has world-wide appeal, from developed industrialized countries to the developing world. Development of innovative technologies to achieve sustainability is being addressed by many European countries, the USA and also China and India. The need for chemical processes to be safe, compact, flexible, energy efficient, and environmentally benign and conducive to the rapid commercialization of new products poses new challenges for chemical engineers. This book examines the newest technologies for sustainable development in chemical engineering, through careful analysis of the technical aspects, and discussion of the possible fields of industrial development. The book is broad in its coverage, and is divided into four sections: Energy Production, covering renewable energies, innovative solar technologies, cogeneration plants, and smart grids; Process Intensification, describing why it is important in the chemical and petrochemical industry, the engineering approach, and nanoparticles as a smart technology for bioremediation; Bio-based Platform Chemicals, including the production of bioethanol and biodiesel, bioplastics production and biodegradability, and biosurfactants; Soil and Water Remediation, covering water management and re-use, and soil remediation technologies. Throughout the book there are case studies and examples of industrial processes in practice.

Process Intensification in Chemical Engineering - Juan Gabriel Segovia-Hernández 2016-04-02

This book will provide researchers and graduate students with an overview of the recent developments and applications of process intensification in chemical engineering. It will also allow the readers to apply the available intensification techniques to their processes and specific problems. The content of this book can be readily adopted as part of special courses on process control, design, optimization and modelling aimed at senior undergraduate and graduate students. This book will be a useful resource for researchers in process system engineering as well as for practitioners interested in applying process intensification approaches to real-life problems in chemical engineering and related areas.

Process Intensification - Fernando Israel Gómez-Castro 2019-10-21

Intensified processes have found widespread application in the chemical and petrochemical industries. The use of intensified systems allows for a reduction of operating costs and supports the "greening" of chemical processes. However, the design of intensified equipment requires special methodologies. This book describes the fundamentals and applications of these design methods, making it a valuable resource for use in both industry and academia.

Process Integration and Intensification - Jirí Jaromír Klemeš 2014-05-26

"The authors have provided all the elements required for complete understanding of the basic concepts in heat recovery and water minimization in chemical and related processes, and followed these with carefully selected and developed problems and solutions in order to ensure that the concepts delivered can be applied." Simon Perry, The University of Manchester. This graduate textbook covers fundamentals of the key areas of Process Integration and Intensification for intra-process heat recovery (Heat Integration), inter-process heat recovery and cogeneration (Total Site) as well as water conservation. Step by step working sessions are illustrated for deeper understanding of the taught materials. The textbook also provides a wealth of pointers as well as further information for readers to acquire more extensive materials on the diverse industrial applications and the latest development trends in Process Integration and Intensification. It is addressed to graduate students as well as professionals to help the effective application of Process

Integration and Intensification in plant design and operation.

Sustainable Industrial Chemistry - Fabrizio Cavani 2009-09-22

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.

Process Intensification for Sustainable Energy Conversion - Fausto Gallucci 2015-05-18

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Presents comprehensive coverage of process intensification and integration for sustainable design, along with fundamental techniques and experiences from the industry. Drawing from fundamental techniques and recent industrial experiences, this book discusses the many developments in process intensification and integration and focuses on increasing sustainability via several overarching topics such as Sustainable Manufacturing, Energy Saving Technologies, and Resource Conservation and Pollution Prevention Techniques. Process Intensification and Integration for Sustainable Design starts discussions on: shale gas as an option for the production of chemicals and challenges for process intensification; the design and techno-economic analysis of separation units to handle feedstock variability in shale gas treatment; RO-PRO desalination; and techno-economic and environmental assessment of ultrathin polysulfone membranes for oxygen-enriched combustion. Next, it looks at process intensification of membrane-based systems for water, energy, and environment applications; the design of internally heat-integrated distillation column (HIDiC); and graphical analysis and integration of heat exchanger networks with heat pumps. Decomposition and implementation of large-scale interplant heat integration is covered, as is the synthesis of combined heat and mass exchange networks (CHAMENs) with renewables. The book also covers optimization strategies for integrating and intensifying housing complexes; a sustainable biomass conversion process assessment; and more. Covers the many advances and changes in process intensification and integration. Provides side-by-side discussions of fundamental techniques and recent industrial experiences to guide practitioners in their own processes. Presents comprehensive coverage of topics relevant, among others, to the process industry, biorefineries, and plant energy management. Offers insightful analysis and integration of reactor and heat exchanger network. Looks at optimization of integrated water and multi-regenerator membrane systems involving multi-contaminants. Process Intensification and Integration for Sustainable Design is an ideal book for process engineers, chemical engineers, engineering scientists, engineering consultants, and chemists.

Sustainable Engineering - Yasar Demirel 2023-08-04

Sustainable engineering is of great importance for resilient and agile technology and society. This book balances economics, environment, and societal elements of sustainable engineering by integrating process intensification, energy analysis, and artificial intelligence to reduce production costs, improve the use of material and energy, product quality, safety, societal well-being, and water usage. The book provides comprehensive discussion of topics on process intensification, energy analysis, and artificial intelligence that include optimization, energy integration, green engineering, pinch analysis, exergy analysis, feasibility analysis, life cycle assessment, circular economy, bioeconomy, data processing, machine learning, expert systems, digital twins, and self-optimized plants for sustainable engineering.

The Fundamentals of Process Intensification - Andrzej Stankiewicz 2019-06-13

This advanced textbook covering the fundamentals and industry applications of process intensification (PI)

discusses both the theoretical and conceptual basis of the discipline. Since interdisciplinarity is a key feature of PI, the material contained in the book reaches far beyond the classical area of chemical engineering. Developments in other relevant disciplines, such as chemistry, catalysis, energy technology, applied physics, electronics and materials science, are extensively described and discussed, while maintaining a chemical engineering perspective. Divided into three major parts, the first introduces the PI principles in detail and illustrates them using practical examples. The second part is entirely devoted to fundamental approaches of PI in four domains: spatial, thermodynamic, functional and temporal. The third and final part explores the methodology for applying fundamental PI approaches in practice. As well as detailing technologies, the book focuses on safety, energy and environmental issues, giving guidance on how to incorporate PI in plant design and operation -- safely, efficiently and effectively.

Process Intensification Technologies for Green Chemistry - Kamelia Boodhoo 2013-01-03

The successful implementation of greener chemical processes relies not only on the development of more efficient catalysts for synthetic chemistry but also, and as importantly, on the development of reactor and separation technologies which can deliver enhanced processing performance in a safe, cost-effective and energy efficient manner. Process intensification has emerged as a promising field which can effectively tackle the challenges of significant process enhancement, whilst also offering the potential to diminish the environmental impact presented by the chemical industry. Following an introduction to process intensification and the principles of green chemistry, this book presents a number of intensified technologies which have been researched and developed, including case studies to illustrate their application to green chemical processes. Topics covered include: • Intensified reactor technologies: spinning disc reactors, microreactors, monolith reactors, oscillatory flow reactors, cavitation reactors • Combined reactor/separator systems: membrane reactors, reactive distillation, reactive extraction, reactive absorption • Membrane separations for green chemistry • Industry relevance of process intensification, including economics and environmental impact, opportunities for energy saving, and practical considerations for industrial implementation. Process Intensification for Green Chemistry is a valuable resource for practising engineers and chemists alike who are interested in applying intensified reactor and/or separator systems in a range of industries to achieve green chemistry principles.

Intensification of Sorption Processes - Mahmood Reza Rahimi 2021-11-23

Intensification of Sorption Processes: Active and Passive Mechanisms introduces a number of selected, advanced topics in sorption processes/process intensification, covering both theoretical and applicable aspects. The first part of the book is devoted to the study of sorption processes based on active mechanisms, including ultrasonic, microwave, high-gravity, electrical and magnetic fields, while the second part covers passive mechanisms like nanostructures and nanofluids, membrane, supercritical fluids and sorption processes based on geometry design and equipment structure. The focus of the book is on key aspects of novel process intensification technologies (processes and equipment), i.e., absorption and adsorption, working principles, and design and applications. Covers all developments in the field of active and passive mechanisms for sorption processes. Introduces basic principles of any intensified sorption process, along with details of equipment. Evaluates industrial upscaling, economic evaluation/justification, future opportunities and challenges for each sorption process.

Smart Manufacturing - Masoud Soroush 2020-08-04

Research efforts in the past decade have led to considerable advances in the concepts and methods of smart manufacturing. Smart Manufacturing: Applications and Case Studies includes information about the key applications of these new methods, as well as practitioners' accounts of real-life applications and case studies. Written by thought leaders in the field from around the world, Smart Manufacturing: Applications and Case Studies is essential reading for graduate students, researchers, process engineers and managers. It is complemented by a companion book titled Smart Manufacturing: Concepts and Methods, which describes smart manufacturing methods in detail. Includes examples of applications of smart manufacturing in process industries. Provides a thorough overview of the subject and practical examples of applications through well researched case studies. Offers insights and accounts of first-hand experiences to motivate further implementations of the key concepts of smart manufacturing.

Reactive and Membrane-Assisted Separations - Philip Lutze 2015-07-15

Process intensification aims for increasing efficiency and sustainability of (bio-)chemical production processes. This book presents strategies for improving fluid separation such as reactive distillation, reactive absorption and membrane assisted separations. The authors discuss computer simulation, model development, methodological approaches for synthesis and the design and scale-up of the final industrial processes.

Process Intensification - Jan Harmsen 2020-07-20

Process Intensification is a comprehensive textbook and treats the theory of process intensification design, and all innovation steps from idea generation to commercial implementation, and all focused on contributing to the UN Sustainable Development Goals. This book covers the 'hard' elements of design, modelling, and experimental validations and the 'soft' elements, values of engineers, interests of stakeholders and beliefs of society.

Reactive and Membrane-Assisted Separations - Philip Lutze 2016-07-28

Process intensification aims for increasing efficiency and sustainability of (bio-)chemical production processes. This book presents strategies for improving fluid separation such as reactive distillation, reactive absorption and membrane assisted separations. The authors discuss computer simulation, model development, methodological approaches for synthesis and the design and scale-up of final industrial processes.

Chemical Engineering- Towards Sustainability and Intensification - Dr. Sunil Jayant Kulkarni 2021-12-20

Advances in chemical engineering are focused on intensification of reactions, unit operations and mechanical operations. Intensification facilitates reduction in cost, size and increase in conversion, separation and selectivity. In case of distillation, reactive distillation can reduce energy cost and increase product quality considerably compared to conventional reactor- separator method. Similar advantages can be considered for reaction adsorption and other reactive separations. Use of non-renewable energy sources can reduce burden on conventional feed stocks and reduce carbon foot prints. Nano materials are gaining importance due to their unique properties. Application of nanomaterial for process intensification is being explored in mass transfer, heat transfer and reaction engineering. The composition of flue gases depends on raw material and process. It is important to have adequate knowledge of these aspects while selecting treatment methods. Various chemical conversion methods are effective for the treatment of flue gases. The recovery of components from flue gases involves adsorption, absorption, stripping, and desorption methods. This book contains one chapter on food adulteration also. Food adulteration is very increasing and dangerous phenomenon. It is being practiced from ancient times. Adulteration for maximizing profit is very commonly practiced unethical practice. There is need for increasing moral and ethical values. There is need for people friendly methods for analysing or at least identification of adulterations. Also use of branded items can minimize harms due to adulteration. The chapters in this book are focused on non-renewable energy (chapters 1, 5, 9), water treatment and recycle (chapters 4, 10, 11, 12), use of advanced materials for catalysts (chapters 2, 3, 13), flue gas heat recovery (14), Intensification of unit operations (5, 6, 7, 8) and adulteration in food products.

Environmental Sustainability and Industries - Pardeep Singh 2022-06-17

Environmental Sustainability and Industries identifies and discusses critical areas related to environmentally conscious industrial development of products and services that may support more sustainable and equitable societies. This book addresses pollution prevention by referring to the use of processes, practices, and materials that reduce or eliminate the generation of pollutants at the source of production, more efficient use of raw materials, energy, water or other resources, or by conserving natural resources by maintaining clean production. It explains industrial energy efficiency as the most cost-effective use of energy in manufacturing processes, reducing its wastage as well as the total consumption of primary energy resources. Life cycle assessment is used as an analytical method to quantify environmental impacts, focusing on environmental considerations concerning process design and optimization, and including various sustainable manufacturing parameters in the context of industrial processes and proposes a classification of identified parameters to evaluate and optimize the manufacturing performances. The book also dives into industrial ecology, investigating how, where, and why environmental improvements can be made to develop a sustainable

industry, meeting the needs of current generations without sacrificing the needs of the future ones. This book analyzes a company's environmental, social, and economic performance and their interrelationships, emphasizing the importance of identifying and understanding causal relationships between alternative approaches to action and their impact on financial and nonfinancial performance. It concludes with a view on the future of sustainable industrial systems stressing change as a joint effort of scientists, governments, people in business, and academicians. Offers compiled information on the environmental sustainability for industry Provides principles and advanced trends and approaches for environmental sustainability for the industrial sector Discusses established and emerging technologies and processes for sustainable approaches for industry Presents the development in the use of the assessment models as a tool to support the research and applications of different sustainable technologies and processes

27th European Symposium on Computer Aided Process Engineering - 2017-09-21

27th European Symposium on Computer Aided Process Engineering, Volume 40 contains the papers presented at the 27th European Society of Computer-Aided Process Engineering (ESCAPE) event held in Barcelona, October 1-5, 2017. It is a valuable resource for chemical engineers, chemical process engineers, researchers in industry and academia, students, and consultants for chemical industries. Presents findings and discussions from the 27th European Society of Computer-Aided Process Engineering (ESCAPE) event

Reactive Separation for Process Intensification and Sustainability - Carlos Ariel Cardona Alzate 2019-12-20

This book describes, analyses and discusses the main principles, phenomena and design strategies of reactive separation processes with an emphasis on the intensification as a basis of the sustainability. Different reactive separation processes are explained in detail to show the phenomena and with the purpose of understanding when their use allows advantages based on the output results. Case examples are analysed and the perspective of these processes in the future is discussed. The overall sustainability of reactive separation processes in the industry is also explained separately.

Measuring Progress Towards Sustainability - Subhas K. Sikdar 2016-11-21

This book is a state of the art treatise on what has been done so far on measuring sustainability for decision making. Contributions will appeal to engineers and scientists engaged in technology development, assessment, and verification. Researchers working on engineering sustainability are likely to get ideas for further research in quantifying sustainability for industrial systems. Concepts described can be applied across all scales, from process technology to global sustainability; and challenges and limitations are also addressed. Readers will discover important insights about simulation-based approaches to process design and quantitative measurement techniques of sustainability for business and technology systems. Most of the examples and case studies are from chemical enterprises but the methodologies presented could be applicable to any system for which quantitative data for indicators are available, and the choice of the set of indicators of sustainability are comprehensive.

Intensification of Biobased Processes - Andrzej Górak 2018-06-18

In recent years bioprocessing has increased in popularity and importance, however, bioprocessing still poses various important techno-economic and environmental challenges, such as product yields, excessive energy consumption for separations in highly watery systems, batch operation or the downstream processing bottlenecks in the production of biopharmaceutical products. Many of those challenges can be addressed by application of different process intensification technologies discussed in the present book. The first book dedicated entirely to this area, *Intensification of Biobased Processes* provides a comprehensive overview of

modern process intensification technologies used in bioprocessing. The book focusses on four different categories of biobased products: bio-fuels and platform chemicals; cosmeceuticals; food products; and polymers and advanced materials. It will cover various intensification aspects of the processes concerned, including (bio)reactor intensification; intensification of separation, recovery and formulation operations; and process integration. This is an invaluable source of information for researchers and industrialists working in chemical engineering, biotechnology and process engineering.

Process Intensification - Mirko Skiborowski 2022-06-06

Process intensification aims for increasing efficiency and sustainability of (bio-)chemical production processes. This book presents strategies for the intensification of fluid separation processes such as reactive distillation, reactive absorption and membrane assisted separations. The authors discuss theoretical fundamentals, model development, methods for synthesis and the design as well as scale-up and industrial process applications.

Process Intensification - David Reay 2013-06-05

Process Intensification: Engineering for Efficiency, Sustainability and Flexibility is the first book to provide a practical working guide to understanding process intensification (PI) and developing successful PI solutions and applications in chemical process, civil, environmental, energy, pharmaceutical, biological, and biochemical systems. Process intensification is a chemical and process design approach that leads to substantially smaller, cleaner, safer, and more energy efficient process technology. It improves process flexibility, product quality, speed to market and inherent safety, with a reduced environmental footprint. This book represents a valuable resource for engineers working with leading-edge process technologies, and those involved research and development of chemical, process, environmental, pharmaceutical, and bioscience systems. No other reference covers both the technology and application of PI, addressing fundamentals, industry applications, and including a development and implementation guide Covers hot and high growth topics, including emission prevention, sustainable design, and pinch analysis World-class authors: Colin Ramshaw pioneered PI at ICI and is widely credited as the father of the technology

Contemporary Catalysis - Paul C J Kamer 2017-07-05

Encompassing an integrated approach to the various aspects of catalysis, covering heterogeneous, homogeneous, organo-, bio-, and computational catalysis, as well as reaction and reactor engineering on an advanced level, this textbook is ideal for graduate students with diverse backgrounds, including catalysis, engineering, and organic synthesis. The basic principles of the various fields of catalysis are introduced in a concise way, preparing the reader for the more advanced chapters. Organometallic chemistry, surface science, biochemistry, nanoscience, transport phenomena and kinetics, reactor and reaction engineering are presented, spanning from the underlying science to industrial applications. Several important case studies on industrial applications are given. It includes catalyst preparation and characterisation and explores recent developments in the understanding of catalytic mechanisms, exploring advanced techniques such as operando spectroscopy.

Sustainable Process Integration and Intensification - Jirí Jaromír Klemeš 2018-04-23

In its second edition, *Sustainable Process Integration and Intensification* continues the presentation of fundamentals of key areas of both fields. Thoroughly updated and extended to include the latest developments, the reader also finds illustrated working sessions for deeper understanding of the taught materials. The book is addressed to graduate students as well as professionals to help the effectively application in plant design and operation.