



# Engineering Green Chemical Processes Renewable And Sustainable Design

**Jo Dewulf, Steven De Meester, Rodrigo  
A. F. Alvarenga**



## **Engineering Green Chemical Processes Renewable And Sustainable Design:**

Engineering Green Chemical Processes Thomas F. DeRosa, 2015-02-05 Cutting edge advances in green chemistry Based on data from the United States Patent and Trademark Office Engineering Green Chemical Processes describes sustainable breakthroughs in chemical research and industrial engineering The chemical agents and polymers described in this book were synthesized without the use of petrochemicals as reagents Instead they were obtained solely through synthetic methods which minimize or eliminate chemical waste require minimum energy input and use renewable materials Emerging synthetic selections currently under investigation in both academic and industrial research facilities worldwide are also discussed in this pioneering work Applications covered include Antibiotics Automotive Biosolvents Candles Chemical additives Coatings Cosmetics Detergents Diesel fuel Eyeglasses Fibers Food packaging Gasoline Industrial chemicals Lubricants Nanoparticles Paint Photosensitive additives Plasticizers Polymers Remediation processes Roadway repairs Surfactants Thermoplastics Toners Process Intensification in Chemical Engineering Juan Gabriel Segovia-Hernández, Adrián

Bonilla-Petriciolet, 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

**Materials for the 21st Century** David Segal, 2017-05-19 What does cotton candy which dissolves at the touch have in common with Kevlar used for bullet proof vests How can our understanding of such materials help us to tackle essential problems of the 21st century Materials play a key role in our search for solutions to many pressing issues They underpin many industries are critical for the development of consumer goods are essential components of medical diagnostic techniques offer hope for the treatment of currently incurable diseases and provide answers to environmental problems This handbook is a guide to the materials we rely on for the future Materials for the 21st Century serves as a useful resource for undergraduate and high school students preparing for a career in physical sciences life sciences or engineering by helping them to identify new areas of interest It is also an excellent reference for readers interested in learning more about the diverse range of materials that underlie key aspects of our economy and everyday lives *Sustainable Green Chemical Processes and their Allied Applications* Inamuddin, Abdullah Asiri, 2020-05-30 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

**Applications in Design and Simulation of Sustainable Chemical Processes** Alexandre C. Dimian, Costin Sorin Bildea, Anton A. Kiss, 2019-08-08 Applications in Design and Simulation of Sustainable Chemical Processes addresses the challenging applications in designing eco friendly but efficient chemical processes including recent advances in chemistry and catalysis that rely on renewable raw materials Grounded in the fundamental knowledge of chemistry thermodynamics chemical reaction engineering and unit operations this book is an indispensable resource for developing and designing innovating chemical processes by employing computer simulations as an efficient conceptual tool Targeted to graduate and post graduate students in chemical engineering as well as to professionals the book aims to advance their skills in process innovation and conceptual design The work completes the book Integrated Design and Simulation of Chemical Processes by Elsevier 2014 authored by the same team Includes comprehensive case studies of innovative processes based on renewable raw materials Outlines Process Systems Engineering approach with emphasis on systematic design methods Employs steady state and dynamic process simulation as problem analysis and flowsheet creation tool Applies modern concepts as process integration and intensification for enhancing the sustainability

**Integrated Design and Simulation of Chemical Processes** Alexandre C. Dimian, Costin Sorin Bildea, Anton A. Kiss, 2014-09-18 This comprehensive work shows how to design and develop innovative optimal and sustainable chemical processes by applying the principles of process systems engineering leading to integrated sustainable processes with green attributes Generic systematic methods are employed supported by intensive use of computer simulation as a powerful tool for mastering the complexity of physical models New to the second edition are chapters on product design and batch processes with applications in specialty chemicals process intensification methods for designing compact equipment with high energetic efficiency plantwide control for managing the key factors affecting the plant dynamics and operation health safety and environment issues as well as sustainability analysis for achieving high environmental performance All chapters are completely rewritten or have been revised This new edition is suitable as teaching material for Chemical Process and Product Design courses for graduate MSc students being compatible with academic requirements world wide The inclusion of the newest design methods will be of great value to professional chemical engineers Systematic approach to developing innovative and sustainable chemical processes Presents generic

principles of process simulation for analysis creation and assessment Emphasis on sustainable development for the future of process industries

**Introduction to Chemical Engineering** Uche P. Nnaji, 2019-09-30 The field of chemical engineering is undergoing a global renaissance with new processes equipment and sources changing literally every day It is a dynamic important area of study and the basis for some of the most lucrative and integral fields of science Introduction to Chemical Engineering offers a comprehensive overview of the concept principles and applications of chemical engineering It explains the distinct chemical engineering knowledge which gave rise to a general purpose technology and broadest engineering field The book serves as a conduit between college education and the real world chemical engineering practice It answers many questions students and young engineers often ask which include How is what I studied in the classroom being applied in the industrial setting What steps do I need to take to become a professional chemical engineer What are the career diversities in chemical engineering and the engineering knowledge required How is chemical engineering design done in real world What are the chemical engineering computer tools and their applications What are the prospects present and future challenges of chemical engineering And so on It also provides the information new chemical engineering hires would need to excel and cross the critical novice engineer stage of their career It is expected that this book will enhance students understanding and performance in the field and the development of the profession worldwide Whether a new hire engineer or a veteran in the field this is a must have volume for any chemical engineer s library

**Sustainable Process Engineering** Gyorgy Szekely, 2024-07-01 Sustainable process engineering is a methodology to design new and redesign existing processes that follow the principles of green chemistry and green engineering and ultimately contribute to a sustainable development The newest achievements of chemical engineering opened new opportunities to design more efficient safe compact and environmentally benign chemical processes The book provides a guide to sustainable process design applicable in various industrial fields Discusses the topic from a wide angle chemistry materials processes and equipment Includes state of the art research achievements that are yet to be industrially implemented Transfers knowledge between chemists and chemical engineers QR codes direct the readers to animations short videos magazines and blogs on specific topics Worked examples deepen the understanding of the sustainable assessment of chemical manufacturing processes

**The Chemical Engineer's Guide To Process Design and Industrial Excellence** Dr. Manoj R Kadam, 2025-02-25

**Chemical Process Engineering Volume 1** Rahmat Sotudeh-Gharebagh, A. Kayode Coker, 2022-03-25 Written by two of the most prolific and respected chemical engineers in the world this groundbreaking two volume set is the new standard in the industry offering engineers and students alike the most up do date comprehensive and state of the art coverage of processes and best practices in the field today This first new volume in a two volume set explores and describes integrating new tools for engineering education and practice for better utilization of the existing knowledge on process design Useful not only for students professors scientists and practitioners especially process chemical mechanical and metallurgical engineers it is also

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**Chemical Process Engineering, Volume 2** A. Kayode Coker, Rahmat Sotudeh-Gharebagh, 2022-06-20 CHEMICAL PROCESS ENGINEERING Written by one of the most prolific and respected chemical engineers in the world and his co author also a well known and respected engineer this two volume set is the new standard in the industry offering engineers and students alike the most up do date comprehensive and state of the art coverage of processes and best practices in the field today This new two volume set explores and describes integrating new tools for engineering education and practice for better utilization of the existing knowledge on process design Useful not only for students university professors and practitioners especially process chemical mechanical and metallurgical engineers it is also a valuable reference for other engineers consultants technicians and scientists concerned about various aspects of industrial design The text can be considered as complementary to process design for senior and graduate students as well as a hands on reference work or refresher for engineers at entry level The contents of the book can also be taught in intensive workshops in the oil gas petrochemical biochemical and process industries The book provides a detailed description and hands on experience on process design in chemical engineering and it is an integrated text that focuses on practical design with new tools such as Microsoft Excel spreadsheets and UniSim simulation software Written by two of the industry s most trustworthy and well known authors this book is the new standard in chemical biochemical pharmaceutical petrochemical and petroleum refining Covering design analysis simulation integration and perhaps most importantly the practical application of Microsoft Excel UniSim software this is the most comprehensive and up to date coverage of all of the latest developments in the industry It is a must have for any engineer or student s library

**Oxide Semiconductors for Solar Energy Conversion** Janusz Nowotny, 2016-04-19 Oxide semiconductors including titanium dioxide  $\text{TiO}_2$  are increasingly being considered as replacements for silicon in the development of the next generation of solar cells Oxide Semiconductors for Solar Energy Conversion Titanium Dioxide presents the basic properties of binary metal oxide semiconductors and the performance related properties

**Carbon-Neutral Fuels and Energy Carriers** Nazim Z. Muradov, T. Veziroğlu, 2016-04-19 Concerns over an unstable energy supply and the adverse environmental impact of carbonaceous fuels have triggered considerable efforts worldwide to find carbon free or low carbon alternatives to conventional fossil fuels Carbon Neutral Fuels and Energy Carriers emphasizes the vital role of carbon neutral energy sources transportation fuels and associated technologies for establishing a sustainable energy future Each chapter draws on the insight of world renowned experts in such diverse fields as photochemistry and electrochemistry solar and nuclear energy biofuels and synthetic fuels carbon sequestration and alternative fuel vehicles After an introductory chapter on different energy options in a carbon constrained world and proposed measures to stabilize atmospheric CO<sub>2</sub> the book analyzes the advantages and challenges facing the introduction of hydrogen fuel to the marketplace It then examines the role of nuclear power in the production of carbon free energy and fuels as well as the efficient use and storage of renewable energy resources emphasizing the production of solar fuels from water and CO<sub>2</sub> The book also discusses different aspects of bioenergy and biofuels production and use and the potential role of bio inspired energy systems and industrial processes The final chapters present a thorough overview and analysis of state of the art fossil fuel decarbonization technologies and clean transportation options This authoritative work provides the information needed to make more informed choices regarding available clean energy and fuel alternatives It helps readers to better understand the interconnection between energy and the environment as well as the potential impact of human activities on climate

*Chemical Processes for a Sustainable Future* Trevor Letcher, Janet Scott, Darrell Patterson, 2015-11-09 This comprehensive book approaches sustainability from two directions the reduction of pollution and the maintaining of existing resources both of which are addressed in a thorough examination of the main chemical processes and their impact Divided into five sections each introduced by a leading expert in the field the book takes the reader through the various types of chemical processes demonstrating how we must find ways to lower the environmental cost of both pollution and contributions to climate change of producing chemicals Each section consists of several chapters presenting the latest facts and opinion on the methodologies being adopted by the chemical industry to provide a more sustainable future A follow up to *Materials for a Sustainable Future* Royal Society of Chemistry 2012 this book will appeal to the same broad readership industrialists and investors policy makers in local and central governments students teachers scientists and engineers working in the field and finally editors journalists and the general public who need information on the increasingly popular concepts of sustainable living

**Kern's Process Heat Transfer** Ann Marie Flynn, Toshihiro Akashige, Louis Theodore, 2019-05-29 This edition ensures the legacy of the original 1950 classic *Process Heat Transfer* by Donald Q Kern that by many is held to be the gold standard This second edition book is divided into three parts Fundamental Principles Heat Exchangers and Other Heat Transfer Equipment Considerations Part I provides a series of chapters concerned with introductory topics that are required when solving heat transfer problems This part of the book deals with topics such as

steady state heat conduction unsteady state conduction forced convection free convection and radiation Part II is considered by the authors to be the meat of the book and the primary reason for undertaking this project Other than minor updates Part II remains relatively unchanged from the first edition Notably it includes Kern s original design methodology for double pipe shell and tube and extended surface heat exchangers Part II also includes boiling and condensation boilers cooling towers and quenchers as well as newly designed open ended problems Part III of the book examines other related topics of interest including refrigeration and cryogenics batch and unsteady state processes health safety and the accompanying topic of risk In addition this part also examines the impact of entropy calculations on exchanger design A 36 page Appendix includes 12 tables of properties layouts and design factors WHAT IS NEW IN THE 2ND EDITION Changes that are addressed in the 2nd edition so that Kern s original work continues to remain relevant in 21st century process engineering include Updated Heat Exchanger Design Increased Number of Illustrative Examples Energy Conservation Entropy Considerations Environmental Considerations Health Safety Risk Assessment Refrigeration and Cryogenics      **Sustainability Assessment of**

**Renewables-Based Products** Jo Dewulf, Steven De Meester, Rodrigo A. F. Alvarenga, 2016-01-19 Over the past decade renewables based technology and sustainability assessment methods have grown tremendously Renewable energy and products have a significant role in the market today and the same time sustainability assessment methods have advanced with a growing standardization of environmental sustainability metrics and consideration of social issues as part of the assessment Sustainability Assessment of Renewables Based Products Methods and Case Studies is an extensive update and sequel to the 2006 title Renewables Based Technology Sustainability Assessment It discusses the impressive evolution and role renewables have taken in our modern society highlighting the importance of sustainability principles in the design phase of renewable based technologies and presenting a wide range of sustainability assessment methods suitable for renewables based technologies together with case studies to demonstrate their applications This book is a valuable resource for academics businesses and policy makers who are active in contributing to more sustainable production and consumption For more information on the Wiley Series in Renewable Resources visit [www.wiley.com/go/rrs](http://www.wiley.com/go/rrs) Topics covered include The growing role of renewables in our society Sustainability in the design phase of products and processes Principles of sustainability assessment Land use analysis Water use analysis Material and energy flow analysis Exergy and cumulative exergy analysis Carbon and environmental footprint methods Life Cycle Assessment LCA social Life Cycle Assessment and Life Cycle Costing LCC Case studies renewable energy bio based chemicals and bio based materials      **Algal Bioreactors** Eduardo Jacob-Lopes, Leila Queiroz Zepka, Mariany Costa Depa, 2024-11-21 Algal Bioreactors Science Engineering and Technology of Upstream Processes Volume One is part of a comprehensive two volume set that provides all of the knowledge needed to design develop and operate algal bioreactors for the production of renewable resources Supported by critical parameters and properties mathematical models and calculations methods and practical real world case studies readers will



find everything they need to know on the upstream and downstream processes of algal bioreactors for renewable resource production Bringing together renowned experts in microalgal biotechnology this book will help researchers scientists and engineers from academia and industry overcome barriers and advance the production of renewable resources and renewable energy from algae Students will also find invaluable explanations of the fundamentals and key principles of algal bioreactors making it an accessible read for students of engineering microbiology biochemistry biotechnology and environmental sciences Presents the physical biological environmental and economic parameters of upstream processes in the operation and development of algal bioreactors to produce renewable resources Explains the main configurations and designs of algal bioreactors presenting recent innovations and future trends Integrates the scientific engineering technology environmental and economic aspects of producing renewable resources and other valuable bioproducts using algal bioreactors Provides real world case studies at various scales to demonstrate the practical implementation of the various technologies and methods discussed

*Integrated Biorefineries* Paul R. Stuart, Mahmoud M. El-Halwagi, 2012-12-10 *Integrated Biorefineries Design Analysis and Optimization* examines how to create a competitive edge in biorefinery innovation through integration into existing processes and infrastructure Leading experts from around the world working in design synthesis and optimization of integrated biorefineries present the various aspects of this complex process capturing the state of the art in the advancing bioeconomy The book defines an integrated biorefinery as a processing facility that transforms biomass into value added products from biofuels and biochemicals to food and pharmaceuticals The chapters cover biorefinery product and process design supply chains process analysis feedstocks technologies and policy and environmental analysis They focus on second generation feedstocks including forestry resources energy crops agricultural residues oils and various waste materials With the growing interest in sustainability in general and in renewable resources in industrial facilities biorefineries are likely to play increasingly significant roles and have greater economic environmental and societal impact This book fills an information gap by presenting cutting edge advances that can effectively guide engineers and decision makers in the synthesis selection design analysis and optimization of biorefineries

**Product and Process Design** Jan Harmsen, André B. de Haan, Pieter L. J. Swinkels, 2024-05-20 *Product and process design driving sustainable innovation* is the 2nd edition of a comprehensive textbook for product and process design courses at BSc MSc EngD and PhD level It covers both heuristics based design methods as well as systems engineering approaches It contains specific methods to co design products and processes so that both designs are better than when these designs are made separately This integrated combination makes the book unique For making designs that contribute to the Sustainable Development Goals of the United Nations specific methods are provided for the People Planet and Prosperity dimensions This second edition of the book includes examples and exercises for each design method which makes it very suitable for teaching purposes The book is furthermore of interest to industrial process and product developers for many industry branches as it provides methods for design modelling and

experimental validation for each innovation stage It is also very useful for R D managers as it provides guidelines for essential activities in each innovation stage discovery concept feasibility development detailed engineering leading to successful implementations of new processes and new products      Reactive Separation for Process Intensification and Sustainability Carlos Ariel Cardona Alzate, Mariana Ortiz Sanchez, Pisarenko Yury Andrianovich, 2019-12-23 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

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