

# Fluidization Engineering Second Edition Butterworths Series In Chemical Engineering

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## PHELPS VALENTINA

*Butterworths Series in Chemical Engineering Elsevier*

Gasification is one of the most important advancements that has ever occurred in energy production. Using this technology, for example, coal can be gasified into a product that has roughly half the carbon footprint of coal. On a large scale, gasification could be considered a revolutionary development, not only prolonging the life of carbon-based fuels, but making them "greener" and cleaner. As long as much of the world still depends on fossil fuels, gasification will be an environmentally friendlier choice for energy production. But gasification is not just used for fossil fuels. Waste products that would normally be dumped into landfills or otherwise disposed of can be converted into energy through the process of gasification. The same is true of biofeedstocks and other types of feedstocks, thus making another argument for the widespread use of gasification. The Handbook of Gasification Technology covers all aspects of the gasification, in a "one-stop shop," from the basic science of gasification and why it is needed to the energy sources, processes, chemicals, materials, and machinery used in the technology. Whether a veteran engineer or scientist using it as a reference or a professor using it as a textbook, this outstanding new volume is a must-have for any library.

*Concepts of Chemical Engineering for Chemists (Second Edition) Elsevier*

This thoroughly updated edition of Fluid Catalytic Cracking Handbook provides practical information on the design, operation, troubleshooting, and optimization of fluid catalytic cracking (FCC) facilities. Based on the author's years of field experience, this expanded, second edition covers the latest technologies to improve the profitability and reliability of the FCC units, and provides several "no-to-low-cost" practical recommendations. A new chapter supplies valuable recommendations for debottlenecking and optimizing the performance of cat cracker operations.

**Butterworths Monographs in Chemical Engineering** Butterworth-Heinemann

Rotary reactors or rotary kilns are the reactors facilitating the chemical reaction between the gas and solid phases usually at high temperatures. This book, which is written by an expert in the field, describes the principles of the rotary reactor and the mode of its operation. These reactors are

widely used in various chemical process industries (food, pharmaceuticals) and metallurgical industries. The book defines the physiochemical aspects of the rotart reactors and provides theoretical equations of their operation. The first part of this book presents the fundamentals; solid movement, conversion of solids, and heat transfer. The middle part of the book applies these equations to a variety of processes which have been developed so far, and shows how they are used. In its last part, conceptual designs of novel rotary reactors are proposed, which performance characteristics are predicted on the basis of above equations, especially, in gasification of solid wastes. - Defines the rotary reactors and their mode of operation. - Defines all operating parameters and gives equations to predict the operation of rotary reactors under various conditions. - Includes a number of practical examples from various industrial applications (metallurgical waste treatment etc).

*Multiphase Reactive Flows* CRC Press

Particle Technology and Applications presents the theoretical and technological background of particle science and explores up-to-date applications of particle technologies in the chemical, petrochemical, energy, mechanical, and materials industries. It looks at the importance of particle science and technology in the development of efficient chemi

*Light Metals 2013* John Wiley & Sons

The authors have written a practical introductory text exploring the theory and applications of unit operations for environmental engineers that is a comprehensive update to Linvil Rich's 1961 classic work, "Unit Operations in Sanitary Engineering". The book is designed to serve as a training tool for those individuals pursuing degrees that include courses on unit operations. Although the literature is inundated with publications in this area emphasizing theory and theoretical derivations, the goal of this book is to present the subject from a strictly pragmatic introductory point-of-view, particularly for those individuals involved with environmental engineering. This book is concerned with unit operations, fluid flow, heat transfer, and mass transfer. Unit operations, by definition, are physical processes although there are some that include chemical and biological reactions. The unit operations approach allows both the practicing engineer and student to compartmentalize the various operations that constitute a process, and emphasizes introductory engineering principles so that the reader can then satisfactorily predict the performance of the various unit operation equipment.

*Chemical Engineering Design* CRC Press

Including an overview of two of the most common uses of coal: combustion and gasification. First, it outlines problems and possible solutions, and then the nature of coal is described. The book goes on to describe the technical aspects of combustion of pulverized coal and the combustion mechanism of coal in fixed, moving, and fluidized beds. Industrial coal combustion applications are then outlined, together with other combustion applications, including co-firing, coal-water, slurries, and briquettes. Finally, gasification of coal, a possible major clean coal technology of the future, is discussed.

*Chemical Reactor Modeling* CRC Press

Part I: Process design -- Introduction to design -- Process flowsheet development -- Utilities and energy efficient design -- Process simulation -- Instrumentation and process control -- Materials of construction -- Capital cost estimating -- Estimating revenues and production costs -- Economic evaluation of projects -- Safety and loss prevention -- General site considerations -- Optimization in design -- Part II: Plant design -- Equipment selection, specification and design -- Design of pressure vessels -- Design of reactors and mixers -- Separation of fluids -- Separation columns (distillation, absorption and extraction) -- Specification and design of solids-handling equipment -- Heat transfer equipment -- Transport and storage of fluids.

*Transport Phenomena in Materials Processing* Springer

This book provides practicing engineers and students with insight into the design and operation of circulating fluidized bed (CFB) boilers. Through a combination of theoretical concepts and practical experience, this book gives the reader a basic understanding of the many aspects of this subject. Important environmental considerations, including solid waste disposal and predicted emissions, are addressed individually in separate chapters. This book places an emphasis on combustion, hydrodynamics, heat transfer, and material issues, and illustrates these concepts with numerous examples of present applications and past experience. This book also examines the relevance of design and feed-stock parameters to the operation of a CFB boiler; designs of mechanical components, including cyclones, air distributor grids, and solid recycle systems; and special problems CFB boilers present with construction materials.

*Circulating Fluidized Bed Boilers* CRC Press

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 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.

**Fluidization Engineering, 2E** John Wiley & Sons

Together with turbulence, multiphase flow remains one of the most challenging areas of computational mechanics and experimental methods and numerous problems remain unsolved to date. Multiphase flows are found in all areas of technology, at all length scales and flow regimes. The fluids involved can be compressible or incompressible, linear or nonlinear. Because of the complexity of the problems, it is often essential to utilize advanced computational and experimental methods to solve the complex equations that describe them. Challenges in these simulations include modelling and tracking interfaces, dealing with multiple length scales, modelling nonlinear fluids, treating drop breakup and coalescence, characterizing phase structures, and many others. Experimental techniques, although expensive and difficult to perform, are essential to validate models. This book contains papers presented at the Fifth International Conference on Computational Methods in Multiphase Flow, which are grouped into the following topics: Multiphase Flow Simulation; Interaction of Gas, Liquids and Solids; Turbulent Flow; Environmental Multiphase Flow; Bubble and Drop Dynamics; Flow in Porous Media; Heat Transfer; Image Processing; Interfacial Behaviour.

*Fluidization Dynamics* Butterworth-Heinemann

*Introduction to Chemical Reactor Analysis, Second Edition* introduces the basic concepts of chemical reactor analysis and design, an important foundation for understanding chemical reactors, which play a central role in most industrial chemical plants. The scope of the second edition has been significantly enhanced and the content reorganized for improved pedagogical value, containing sufficient material to be used as a text for an undergraduate level two-term course. This edition also contains five new chapters on catalytic reaction engineering. Written so that newcomers to the field can easily progress through the topics, this text provides sufficient knowledge for readers to perform most of the common reaction engineering calculations required for a typical practicing engineer. The authors introduce kinetics, reactor types, and commonly used terms in the first chapter. Subsequent chapters cover a review of chemical engineering thermodynamics, mole balances in ideal reactors for three common reactor types, energy balances in ideal reactors, and chemical reaction kinetics. The text also presents an introduction to nonideal reactors, and explores kinetics and reactors in catalytic systems. The book assumes that readers have some knowledge of thermodynamics, numerical methods, heat transfer, and fluid flow. The authors include an appendix for numerical

methods, which are essential to solving most realistic problems in chemical reaction engineering. They also provide numerous worked examples and additional problems in each chapter. Given the significant number of chemical engineers involved in chemical process plant operation at some point in their careers, this book offers essential training for interpreting chemical reactor performance and improving reactor operation. What's New in This Edition: Five new chapters on catalytic reaction engineering, including various catalytic reactions and kinetics, transport processes, and experimental methods Expanded coverage of adsorption Additional worked problems Reorganized material

*Multiphase Catalytic Reactors* Springer Science & Business Media

The Light Metals series is widely recognized as the definitive source of information on new developments in aluminum production technology. This new volume presents proceedings from 2013's Light Metal Symposia, covering the latest research and technologies on such areas as alumina and bauxite, aluminum reduction technology, electrode technology for aluminum production, cast shop for aluminum production, aluminum processing aluminum alloys, and cost affordable titanium IV. It also includes papers from a keynote presentation session discussing impurities in the aluminum supply chain are also included.

*Chemical Reactor Omnibook- soft cover* Taylor & Francis US

This book presents the current carbonaceous fuel conversion technologies based on chemical looping concepts in the context of traditional or conventional technologies. The key features of the chemical looping processes, their ability to generate a sequestration-ready CO<sub>2</sub> stream, are thoroughly discussed. Chapter 2 is devoted entirely to the performance of particles in chemical looping technology and covers the subjects of solid particle design, synthesis, properties, and reactive characteristics. The looping processes can be applied for combustion and/or gasification of carbon-based material such as coal, natural gas, petroleum coke, and biomass directly or indirectly for steam, syngas, hydrogen, chemicals, electricity, and liquid fuels production. Details of the energy conversion efficiency and the economics of these looping processes for combustion and gasification applications in contrast to those of the conventional processes are given in Chapters 3, 4, and 5. Finally, Chapter 6 presents additional chemical looping applications that are potentially beneficial, including those for H<sub>2</sub> storage and onboard H<sub>2</sub> production, CO<sub>2</sub> capture in combustion flue gas, power generation using fuel cell, steam-methane reforming, tar sand digestion, and chemicals and liquid fuel production. A CD is appended to this book that contains the chemical looping simulation files and the simulation results based on the ASPEN Plus software for such reactors as gasifier, reducer, oxidizer and combustor, and for such processes as conventional gasification processes, Syngas Chemical Looping Process, Calcium Looping Process, and Carbonation-Calcination Reaction (CCR) Process. Note: CD-ROM/DVD and other supplementary materials are not included as part of eBook file.

*Theory, Design, Manufacturing, and Applications* Butterworth-Heinemann

Fluidization Dynamics has been written for students and engineers who find themselves involved with problems concerning the fluidized state. It presents an analysis that focuses directly on the problem of predicting the fluid dynamic behaviour of a proposed fluidized system for which empirical data is limited or unavailable. The second objective is to provide a treatment of fluidization

dynamics that is readily accessible to the non-specialist. The linear approach adopted in this book, starting with the formulation of predictive expressions for the basic forces that act on a fluidized particle, offers a clear way into the theory. The incorporation of the force terms into the conservation equations for mass and momentum and subsequent applications are presented in a manner that requires only the haziest recollection of elementary fluid-dynamics theory. The analyses presented in this book represent a body of research that has appeared in numerous publications over the last 20 years. L.G. Gibilaro has taken the opportunity to reorder much of the material in the light of subsequent knowledge, to correct minor errors and inconsistencies and to add detail and clarification where necessary. This material helps to form the basis for university course modules in engineering and applied science at undergraduate and graduate level, as well as focused, post-experienced courses for the process, and allied industries. · Bridges the gulf between observed behaviour and fluid-dynamic theory · Clear account of basic theory of fluidization · Accessible treatment of fluidization analysis

Elsevier

This book contains selected papers of the 11th OpenFOAM® Workshop that was held in Guimarães, Portugal, June 26 - 30, 2016. The 11th OpenFOAM® Workshop had more than 140 technical/scientific presentations and 30 courses, and was attended by circa 300 individuals, representing 180 institutions and 30 countries, from all continents. The OpenFOAM® Workshop provided a forum for researchers, industrial users, software developers, consultants and academics working with OpenFOAM® technology. The central part of the Workshop was the two-day conference, where presentations and posters on industrial applications and academic research were shown. OpenFOAM® (Open Source Field Operation and Manipulation) is a free, open source computational toolbox that has a larger user base across most areas of engineering and science, from both commercial and academic organizations. As a technology, OpenFOAM® provides an extensive range of features to solve anything from complex fluid flows involving chemical reactions, turbulence and heat transfer, to solid dynamics and electromagnetics, among several others. Additionally, the OpenFOAM technology offers complete freedom to customize and extend its functionalities.

*Combustion and Gasification of Coal* Springer

This text provides a teachable and readable approach to transport phenomena (momentum, heat, and mass transport) by providing numerous examples and applications, which are particularly important to metallurgical, ceramic, and materials engineers. Because the authors feel that it is important for students and practicing engineers to visualize the physical situations, they have attempted to lead the reader through the development and solution of the relevant differential equations by applying the familiar principles of conservation to numerous situations and by including many worked examples in each chapter. The book is organized in a manner characteristic of other texts in transport phenomena. Section I deals with the properties and mechanics of fluid motion; Section II with thermal properties and heat transfer; and Section III with diffusion and mass transfer. The authors depart from tradition by building on a presumed understanding of the relationships between the structure and properties of matter, particularly in the chapters devoted to the transport properties (viscosity, thermal conductivity, and the diffusion coefficients). In addition,

generous portions of the text, numerous examples, and many problems at the ends of the chapters apply transport phenomena to materials processing.

Proceedings of the Seminar on Experimental Approaches in Pyrometallurgical Research. John Wiley & Sons

This book closes the gap between Chemical Reaction Engineering and Fluid Mechanics. It provides the basic theory for momentum, heat and mass transfer in reactive systems. Numerical methods for solving the resulting equations as well as the interplay between physical and numerical modes are discussed. The book is written using the standard terminology of this community. It is intended for researchers and engineers who want to develop their own codes, or who are interested in a deeper insight into commercial CFD codes in order to derive consistent extensions and to overcome "black box" practice. It can also serve as a textbook and reference book.

Gas-Liquid-Solid Fluidization Engineering Elsevier

This authoritative reference work provides a comprehensive review of the management, recycling and reuse of waste composites. These are issues which are of increasing importance due to the growing use of composites in many industries, increasingly strict legislation and concerns about disposal of composites by landfill or incineration. Part one discusses the management of waste composites and includes an introduction to composites recycling and a chapter on EU legislation for recycling waste composites. Part two reviews thermal technologies for recycling waste composites with chapters on pyrolysis, catalytic transformation, thermal treatments for energy recovery and fluidized bed pyrolysis. Part three covers mechanical methods of recycling waste composites. This section includes chapters on additives for recycled plastic composites, improving mechanical recycling and the quality and durability of mechanically recycled composites. Part four discusses improving sustainable manufacture of composites, with chapters on environmentally-friendly filament winding of FRP composites, process monitoring and new developments in producing more functional and sustainable composites. Part five gives a review of case studies including end-of-life

wind turbine blades, aerospace composites, marine composites, composites in construction and the recycling of concrete. With its distinguished editor and international team of contributors, Management, recycling and reuse of waste composites is a standard reference for anyone involved in the disposal or recycling of waste composites. Reviews the increasingly important issues of recycling and reuse as a result of the increased use of composites Discusses the management of waste composites and EU legislation with regards to recycling Examines methods for recycling, including thermal technologies and mechanical methods

Fundamentals of Fluidized-Bed Chemical Processes Fluidization Engineering

Provides a holistic approach to multiphase catalytic reactors from their modeling and design to their applications in industrial manufacturing of chemicals Covers theoretical aspects and examples of fixed-bed, fluidized-bed, trickle-bed, slurry, monolith and microchannel reactors Includes chapters covering experimental techniques and practical guidelines for lab-scale testing of multiphase reactors Includes mathematical content focused on design equations and empirical relationships characterizing different multiphase reactor types together with an assortment of computational tools Involves detailed coverage of multiphase reactor applications such as Fischer-Tropsch synthesis, fuel processing for fuel cells, hydrotreating of oil fractions and biofuels processing

Chemical Looping Systems for Fossil Energy Conversions Springer Science & Business Media

Fundamentals of Fluidized-bed Chemical Processes presents a survey of the design, operation, and chemical processes of fluidized-bed reactors. The book is composed of five chapters. The first chapter examines the basic physics of gas-solid fluidization. The second chapter shows how the physics of gas-solid fluidization may be combined with chemical kinetics to generate models of fluidized-bed reactors. Chapters 3 and 4 deal with two major applications of gas-solid fluidization, the Fluidized Catalytic Cracking process and the combustion and gasification of coal. The final chapter analyzes other processes used in the production of chemicals such as phthalic anhydride, acrylonitrile, and compounds of uranium. Undergraduate and postgraduate students of chemical engineering, engineers, chemists, and scientists will find this text useful.