Fluidized Bed Technologies For Near Zero Emission Combustion And Gasification Woodhead Publishing Series In Energy

· Explains operation and scientific fundamentals of circulating fluidized bed (CFB) boilers · Outlines practical issues in industrial use · Teaches how to optimize design for maximum reliability and efficiency · Discusses operating and maintenance issues and how to troubleshoot them 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. An emphasis on combustion, hydrodynamics, heat transfer, and material issues illustrates these concepts with numerous examples from actual operating plants. The relevance of design and feed-stock parameters to the operation of a CFB boiler are also examined, along with their impacts on designs of mechanical components, including cyclones, air distributor grids, and solid recycle systems. This versatile resource explains how fluidized bed equipment works and how the basic principles of thermodynamics and fluid mechanics influence design, while providing insight into

planning new projects, troubleshooting existing equipment, and appreciating the capabilities and limitations of the process. From hydrodynamics to construction and maintenance, the author covers all of the essential information needed to understand, design, operate, and maintain a complete fluidized bed system. It is a must for clean coal technology as well as for biomass power generation.

Since the late 1970s there has been an explosion of industrial and academic interest in circulating fluidized beds. In part, the attention has arisen due to the environmental advantages associated with CFB (circulating . fluidized bed) combustion systems, the incorporation of riser reactors employing cir culating fluidized bed technology in petroleum refineries for fluid catalytic cracking and, to a lesser extent, the successes of CFB technology for calcina tion reactions and Fischer-Tropsch synthesis. In part, it was also the case that too much attention had been devoted to bubbling fluidized beds and it was time to move on to more complex and more advantageous regime,S of operation. Since 1980 a number of CFB processes have been commercialized. There have been five successful International Circulating Fluidized Bed Confer ences beginning in 1985, the most recent taking place in Beijing in May 1996. In addition, we have witnessed a host of other papers on CFB funda mentals and applications in journals and other archival

publications. There have also been several review papers and books on specific CFB topics. However, there has been no comprehensive book reviewing the field and attempting to provide an overview of both fundamentals and applications. The purpose of this book is to fill this vacuum.

This book provides a detailed overview of the plasma fluidized bed. It is an innovative tool and generally combines plasma process with another efficient reactor, fluidized bed, providing an excellent method for particulate processes over conventional technology. The development and designs of typical types of plasma fluidized beds, mainly thermal plasma fluidized beds and non-thermal plasma fluidized beds are discussed. The influencing factors on the performance of plasma fluidized beds are analyzed in detail. The mechanism, i.e. the discharge characteristics, hydrodynamics, heat transfer and mass transfer are analyzed to offer a further insight of plasma fluidized beds. Applications of plasma fluidized beds for different areas, including metallurgy extraction, green energy process, environmental protection and advanced materials are presented. The book is a valuable reference for scientists, engineers and graduate students in chemical engineering and relative fields.

Fluidization Engineering, Second Edition, expands on its original scope to encompass these new areas and introduces reactor models specifically for these

contacting regimes. Completely revised and updated, it is essentially a new book. Its aim is to distill from the thousands of studies those particular developments that are pertinent for the engineer concerned with predictive methods, for the designer, and for the user and potential user of fluidized beds. Covers the recent advances in the field of fluidization. Presents the studies of developments necessary to the engineers, designers, and users of fluidized beds.

Besides being one of the best Clean Coal Technologies, fluidized beds are also proving to be the most practical option for biomass conversion. Although the technology is well established, the field lacks a comprehensive guide to the design and operating principles of fluidized bed boilers and gasifiers. With more than 30 years of research and industrial experience, Prabir Basu answers this pressing need with Combustion and Gasification in Fluidized Beds. This book is a versatile resource that explains how fluidized bed equipment works and how to use the basic principles of thermodynamics and fluid mechanics in design while providing insight into planning new projects, troubleshooting existing equipment, and appreciating the capabilities and limitations of the process. From hydrodynamics to construction and maintenance, the author covers all of the essential information needed to understand, design, operate, and maintain a complete fluidized

bed system. It is a must for clean coal technology as well as for biomass power generation. Beginning with a general introduction to fossil or biofuel conversion choices, the book surveys hydrodynamics, fundamentals of gasification, combustion of solid fuels, pollution aspects including climate change mitigation, heat transfer in fluidized beds, the design and operation of bubbling and circulating fluidized bed boilers, and various supporting components such as distributor grates, feeding systems, and gas-solid separators.

A realization of recent clean energy initiatives, fluidized bed combustion (FBC) has quickly won industry preference due to its ability to burn materials as diverse as low-grade coals, biomass, and industrial and municipal waste. Fluidized Bed Combustion catalogs the fundamental physical and chemical processes required of bubbling fluidized beds before launching into application-centered coverage of hot-gas generator, incinerator, and boiler concepts and design, calculations for regime parameters and dimensions, and all aspects of FBC operation. It enumerates the environmental consequences of fluidized bed processes and proposes measures to reduce the formation of harmful emissions.

This reference details particle characterization, dynamics, manufacturing, handling, and processing for the employment of multiphase reactors, as well

as procedures in reactor scale-up and design for applications in the chemical, mineral, petroleum, power, cement and pharmaceuticals industries. The authors discuss flow through fixed beds, elutriati Fluidized bed (FB) combustion and gasification are advanced techniques for fuel flexible, high efficiency and low emission conversion. Fuels are combusted or gasified as a fluidized bed suspended by jets with sorbents that remove harmful emissions such as SOx. CO2 capture can also be incorporated. Fluidized bed technologies for near-zero emission combustion and gasification provides an overview of established FB technologies while also detailing recent developments in the field. Part one, an introductory section, reviews fluidization science and FB technologies and includes chapters on particle characterization and behaviour, properties of stationary and circulating fluidized beds, heat and mass transfer and attrition in FB combustion and gasification systems. Part two expands on this introduction to explore the fundamentals of FB combustion and gasification including the conversion of solid, liquid and gaseous fuels, pollutant emission and reactor design and scale up. Part three highlights recent advances in a variety of FB combustion and gasification technologies before part four moves on to focus on emerging CO2 capture technologies. Finally, part five explores other applications of FB technology including (FB)

petroleum refining and chemical production. Fluidized bed technologies for near-zero emission combustion and gasification is a technical resource for power plant operators, industrial engineers working with fluidized bed combustion and gasification systems and researchers, scientists and academics in the field. Examines the fundamentals of fluidized bed (FB) technologies, including the conversion of solid, liquid and gaseous fuels Explores recent advances in a variety of technologies such as pressurized FB combustion, and the measurement, monitoring and control of FB combustion and gasification Discusses emerging technologies and examines applications of FB in other processes

Fluidized beds have been known for over a century, yet widespread application has only occurred in the last fifty years. They are now one of the most important chemical engineering technologies. Applications range from oil refining to drying processes, solids handling systems, boilers, metallurgical heat treatment furnaces and environmental protection measures. Fluidized Bed Technology: Principles and Applications presents the essential facts about beds of solid particles when fluidized by gases, and explains how the technology has been applied to yield fluidized bed boilers, furnaces, heat recovery systems and process plants. The text is accompanied by worked examples, using elementary mathematics, to illustrated practical considerations, and contains comprehensive references for further reading.

Fluidized Bed Technology: Principles and Applications will give the reader confidence to pursue the subject in greater depth and develop their own ideas. This will be a useful text for engineering students, practising professional engineers, engineering consultants, fuel technologists, R & D engineers and scientists, and any who may have to train staff in this area.

Fluid Bed Technology in Materials Processing comprehensively covers the various aspects of fluidization engineering and presents an elaborate examination of the applications in a multitude of materials processing techniques. This singular resource discusses: All the basic aspects of fluidization essential to understand and learn about various techniques The range of industrial applications Several examples in extraction and process metallurgy Fluidization in nuclear engineering and nuclear fuel cycle with numerous examples Innovative techniques and several advanced concepts of fluidization engineering, including use and applications in materials processing as well as environmental and bio-engineering Pros and cons of various fluidization equipment and specialty of their applications, including several examples Design aspects and modeling Topics related to distributors effects and flow regimes A separate chapter outlines the importance of fluidization engineering in high temperature processing, including an analysis of the fundamental concepts and applications of high temperature fluidized bed furnaces for several advanced materials processing techniques. Presenting information usually not available in a single source, Fluid Bed Technology in Materials

Processing serves Fluidization engineers Practicing engineers in process metallurgy, mineral engineering, and chemical metallurgy Researchers in the field of chemical, metallurgical, nuclear, biological, environmental engineering Energy engineering professionals High temperature scientists and engineers Students and professionals who adopt modeling of fluidization in their venture for design and scale up Thermo-Hydrodynamic Design of Fluidized Bed Combustors: Estimating Metal Wastage is a unique volume that finds that the most sensitive parameters affecting metal wastage are superficial fluidizing velocity, particle diameter, and particle sphericity. Gross consistencies between disparate data sources using different techniques were found when the erosion rates are compared on the same basis using the concept of renormalization. The simplified mechanistic models and correlations, when validated, can be used to renormalize any experimental data so they can be compared on a consistent basis using a master equation.

Circulating Fluidized Bed Technology II is a result of a series of science-related conferences in the 1980s. The text contains various studies, facts, and discussions on fluidized beds. The book begins by going through the rise and fall of circulating systems, specifically fluid dynamics. The chapter continues with a wider discussion of hydrodynamics, which includes its scales, particles, and different math formulas. In the several chapters that follow, a thorough study of fluidized beds and its subtopics are presented, which include particle behavior, combustion, heat transfer process, reactors, gas mixing,

parameters, measurements, and characteristics. The variations of fluidized beds, including the multisolid, dual-column, and turbulent, are also given. The book serves as a very useful reference for undergraduates and postgraduates of physics, chemistry, and other related fields.

A concise and clear treatment of the fundamentals of fluidization, with a view to its applications in the process and energy industries.

The fluidized-bed reactor is the centerpiece of industrial fluidization processes. This book focuses on the design and operation of fluidized beds in many different industrial processes, emphasizing the rationale for choosing fluidized beds for each particular process. The book starts with a brief history of fluidization from its inception in the 1940's. The authors present both the fluid dynamics of gas-solid fluidized beds and the extensive experimental studies of operating systems and they set them in the context of operating processes that use fluid-bed reactors. Chemical engineering students and postdocs as well as practicing engineers will find great interest in this book.

How to Optimize Fluid Bed Processing Technology: Part of the Expertise in Pharmaceutical Process Technology Series addresses the important components of fluid bed granulation, providing answers to problems that commonly arise and using numerous practical examples and case studies as reference. This book covers the theoretical concepts involved in fluidization, also providing a description of the choice and functionality of equipment. Additional chapters feature key aspects of the technology, including formulation requirements, process variables, process scale-up, troubleshooting, new development, safety, and process evaluation. Given its discussion of theoretical principles and

practical solutions, this is a go-to resource for all those scientists and new researchers working with fluid bed granulation as a unit operation. Written by an expert in the field with several years of experience in product development, manufacturing, plant operations, and process engineering Illustrates when fluid bed granulation is needed, when to use less common fluid bed granulation methods, and the advantages of fluid bed granulation when compared to other granulation techniques Offers troubleshooting tips and practical advice for scientists working with this technique

This volume focuses on the present status of circulating fluidized bed technology and provides design information not available elsewhere. Areas covered include combustion of fossil fuel, hydrodynamics, combustion and environmental pollution, design and operating experiences, heat transfer and hydrodynamics, and process applications.

Chapters written by experts cover a wide range of subjects, providing a clear picture of the phenomena and mechanisms at work in the process of gas fluidization. Offers the reader a practical understanding of these phenomena and mechanisms. Because the technique of fluidization is used in many different industries for drying, combustion, catalytic reactions, granulation, calcination, etc., this text will be of considerable interest to many and various practitioners and researchers in chemical, mechanical, process and industrial engineering. Illustrative examples and design equations are given so that readers can make their own practical calculations.

Over the last decade, circulating fluidization or fast fluidization has developed rapidly, superseding standard bubbling fluidization in many applications; for example, fast fluidization provides a better means forcontrolling emissions from the combustion of high-sulfur fuels and excels when used in boilers in steam plant and power stations. China initiated the

study of fast fluidization in the early 1970s. Focusing on the substantial research cultivated in that country, with Kwauk at the leading edge, this latest volume in the Advances in Chemical Engineering Series is written in the context of the international state of the art and addresses some of the most vital issues surrounding this fluidization method."
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