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Kockmann

Transport Phenomena in Micro Process Engineering



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R Barnett



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Transport Phenomena in Micro Process Engineering Norbert Kockmann, 2007-11-12 In this book the fundamentals of chemical engineering are presented aiming to applications in micro system technology microfluidics and transport processes within microstructures After a general overview on both disciplines and common areas recent projects are shortly presented The combination of different disciplines gives new opportunities in microfluidic devices and process intensification respectively Special features of the book are the state of the art in micro process engineering a detailed treatment of transport phenomena for engineers a design methodology from transport effects to economic considerations a detailed treatment of chemical reaction in continuous flow microstructured reactors an engineering methodology to treat complex processes The book addresses researchers and graduate students in the field of chemical engineering Microsystems engineering and chemistry

Transport Phenomena Norbert Kockmann, 2008-02-01 Transport Phenomena in Micro Process Engineering puts fundamentals of chemical engineering into context with micro system technology microfluidics and transport processes within microstructures After a general overview about both disciplines and common areas the text presents numerous recent projects as examples The text also applies transport of momentum heat and mass in microstructures to chemical reactors and coupled transport phenomena and their potential are illustrated to the reader The book concludes with an evaluation of the state of the art and an outlook upon the next steps to come in research

Micro Process Engineering, 3 Volume Set Volker Hessel, Albert Renken, Jaap C. Schouten, Jun-Ichi Yoshida, 2009-03-23 This three volume handbook provides an overview of the key aspects of micro process engineering Volume 1 covers the fundamentals operations and catalysts volume 2 examines devices reactions and applications with volume 3 rounding off the trilogy with system process and plant engineering Fluid dynamics mixing heat mass transfer purification and separation microstructured devices and microstructured reactors are explained in the first volume Volume 2 segments microreactor design fabrication and assembly bulk and fine chemistry polymerisation fuel processing and functional materials into understandable parts The final volume of the handbook addresses microreactor systems design and scale up sensing analysis and control chemical process engineering economic and eco efficiency analyses as well as microreactor plant case studies in one book Together this 3 volume handbook explains the science behind micro process engineering to the scale up and their real life industrial applications

Basic Transport Phenomena in Materials Engineering Manabu Iguchi, Olusegun J. Ilegbusi, 2013-09-12 This book presents the basic theory and experimental techniques of transport phenomena in materials processing operations Such fundamental knowledge is highly useful for researchers and engineers in the field to improve the efficiency of conventional processes or develop novel technology Divided into four parts the book comprises 11 chapters describing the principles of momentum transfer heat transfer and mass transfer in single phase and multiphase systems Each chapter includes examples with solutions and exercises to facilitate students learning Diagnostic problems are also provided at the

end of each part to assess students comprehension of the material The book is aimed primarily at students in materials science and engineering However it can also serve as a useful reference text in chemical engineering as well as an introductory transport phenomena text in mechanical engineering In addition researchers and engineers engaged in materials processing operations will find the material useful for the design of experiments and mathematical models in transport phenomena This volume contains unique features not usually found in traditional transport phenomena texts It integrates experimental techniques and theory both of which are required to adequately solve the inherently complex problems in materials processing operations It takes a holistic approach by considering both single and multiphase systems augmented with specific practical examples There is a discussion of flow and heat transfer in microscale systems which is relevant to the design of modern processes such as fuel cells and compact heat exchangers Also described are auxiliary relationships including turbulence modeling interfacial phenomena rheology and particulate systems which are critical to many materials processing operations

Chemical Micro Process Engineering Volker Hessel, Steffen Hardt, Holger Löwe, 2006-03-06 Micro process engineering is approaching both academia and industry With the provision of micro devices and systems by commercial suppliers one main barrier for using these units has been eliminated More and more they become familiar thereby being one facet of the upheaval in chemical industry This book focuses on processes rather than on devices what is before and behind micro device fabrication A comprehensive and detailed overview is given on A multi faceted hierarchic analysis of chemical micro process technology Modelling and simulation of micro reactors Liquid and liquid liquid phase reactions Gas liquid reactions Gas phase reactions heterogeneous catalysis Micro Process Engineering Norbert Kockmann, 2013-03-26 This edition of Micro Process Engineering was originally published in the successful series Advanced Micro Nanosystems Authors from leading industrial players and research institutions present a concise and didactical introduction to Micro Process Engineering the combination of microtechnology and process engineering into a most promising and powerful tool for revolutionizing chemical processes and industrial mass production of bulk materials fine chemicals pharmaceuticals and many other products The book takes the readers from the fundamentals of engineering methods transport processes and fluid dynamics to device conception simulation and modelling control interfaces and issues of modularity and compatibility Fabrication strategies and techniques are examined next focused on the fabrication of suitable microcomponents from various materials such as metals polymers silicon ceramics and glass The book concludes with actual applications and operational aspects of micro process systems giving broad coverage to industrial efforts in America Europe and Asia as well as laboratory equipment and education *Microstructured Devices for Chemical Processing* Madhvanand N. Kashid, Albert Renken, Lioubov Kiwi-Minsker, 2014-12-22 Faster cheaper and environmentally friendly these are the criteria for designing new reactions and this is the challenge faced by many chemical engineers today Based on courses taught by the authors this advanced textbook discusses opportunities for carrying out reactions on an

industrial level in a technically controllable sustainable cost-effective and safe manner Adopting a practical approach it describes how miniaturized devices mixers reactors heat exchangers and separators are used successfully for process intensification focusing on the engineering aspects of microstructured devices such as their design and main characteristics for homogeneous and multiphase reactions It addresses the conditions under which microstructured devices are beneficial how they should be designed and how such devices can be integrated in an existing chemical process Case studies show how the knowledge gained can be applied for particular processes The textbook is essential for master and doctoral students as well as for professional chemists and chemical engineers working in this area Sustainable Process Engineering Andrzej Benedykt Koltuniewicz, 2014-08-19 The vital need for alternative resources and reaction routes environmentally friendly and economically feasible industrial chemical processes has become a ubiquitous reality This very timely introductory text covers new materials processes and industry sectors nanotechnology microreactors membrane separations hybrid processes clean technologies energy savings and safe production of energy renewables and biotechnology Some completely new processes for the solid liquid systems are also discussed in detail thus creating new opportunities of sustainable development not only in industrial practice *Heat and Mass Transfer Modelling During Drying* Mohammad U.H. Joardder, Washim Akram, Azharul Karim, 2021-09-30 Most conventional dryers use random heating to dry diverse materials without considering their thermal sensitivity and energy requirements for drying Eventually excess energy consumption is necessary to attain a low quality dried product Proper heat and mass transfer modelling prior to designing a drying system for selected food materials can overcome these problems *Heat and Mass Transfer Modelling During Drying Empirical to Multiscale Approaches* extensively discusses the issue of predicting energy consumption in terms of heat and mass transfer simulation A comprehensive mathematical model can help provide proper insight into the underlying transport phenomena within the materials during drying However drying of porous materials such as food is one of the most complex problems in the engineering field that is also multiscale in nature From the modelling perspective heat and mass transfer phenomena can be predicted using empirical to multiscale modelling However multiscale simulation methods can provide a comprehensive understanding of the physics of drying food materials **KEY FEATURES** Includes a detailed discussion on material properties that are relevant for drying phenomena Presents an in depth discussion on the underlying physics of drying using conceptual visual content Provides appropriate formulation of mathematical modelling from empirical to multiscale approaches Offers numerical solution approaches to mathematical models Presents possible challenges of different modelling strategies and potential solutions The objective of this book is to discuss the implementation of different modelling techniques ranging from empirical to multiscale in order to understand heat and mass transfer phenomena that take place during drying of porous materials including foods pharmaceutical products paper leather materials and more **Microreaction Technology** M. Matlosz, W. Ehrfeld, J.P. Baselt, 2012-12-06 IMRET 5 featured more than 80 oral and poster communications covering the

entire interdisciplinary field from design production modeling and characterization of microreactor devices to application of microstructured systems for production energy and transportation including many analytical and biological applications A particularly strong topic was the investigation of the potential of microstructuring of reactors and systems components for process intensification Perspectives of combining local in situ data acquisition with appropriate microstructuring of actuators and components within chemical and biological devices were explored in order to enhance process performance and facilitate process control

Process Intensification for Chemical and Biotechnology Industries Shirish H. Sonawane, Sarang P. Gumfekar, Bharat Bhanvase, 2023-09-28 Process Intensification for Chemical Engineering and Biotechnology Industries Fundamentals and Applications to Critical and Advanced Processes shows the importance of process intensification in the pharmaceutical chemical and biotechnology industries The book provides mathematical aspects such as modeling of improved crystallization processes for the design of novel process intensification equipment The book is an indispensable resource for researchers in the pharmaceutical chemical and biotechnology industries covering the fundamentals of process intensification equipment used for fabrication and the implementation of novel trends in process intensification that are cost effective and produce minimum waste and high yield Covers the scientific fundamental engineering and applied aspects of process intensification Analyzes the pros and cons of various intensified equipment and design methodologies Focuses on process intensification in biotechnology chemical engineering and materials engineering Offers a relevant reference for current needs in the pharmaceutical and food industries

Novel Process Windows Volker Hessel, Dana Kralisch, Norbert Kockmann, 2015-03-23 This book introduces the concept of novel process windows focusing on cost improvements safety energy and eco efficiency throughout each step of the process The first part presents the new reactor and process related technologies introducing the potential and benefit analysis The core of the book details scenarios for unusual parameter sets and the new holistic and systemic approach to processing while the final part analyses the implications for green and cost efficient processing With its practical approach this is invaluable reading for those working in the pharmaceutical fine chemicals fuels and oils industries

29th European Symposium on Computer Aided Chemical Engineering Anton A. Kiss, Edwin Zondervan, Richard Lakerveld, Leyla Özkan, 2019-06-28 The 29th European Symposium on Computer Aided Process Engineering contains the papers presented at the 29th European Symposium of Computer Aided Process Engineering ESCAPE event held in Eindhoven The Netherlands from June 16 19 2019 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 29th European Symposium of Computer Aided Process Engineering ESCAPE event

Microwave Processing of Foods: Challenges, Advances and Prospects Anubhav Pratap Singh, Ferruh Erdogdu, Shaojin Wang, Hosahalli S. Ramaswamy, 2024-08-27 The application of microwaves has been a major advancement in food processing over the past 50 years and yet to date there have been very few publications focusing exclusively on

microwave processing and none covering the latest technological and theoretical advances Microwave Processing of Foods Challenges Advances and Prospects fills this gap by covering all aspects of the microwave processing of foods including the latest novel advances in this fast moving subject area This text presents multidisciplinary views of novel microwave systems novel process modeling engineering and design as well as practical approaches on methodology and findings regarding the effect of microwave on the food quality and process safety The volume comprises several chapters on the newest processing and machinery aspects engineering design and process modeling process safety and novel processes based on full or partial application of microwave in food processing This book also considers economic aspects food quality issues and future trends of microwave application in the food industry Each chapter in this text functions as a critical review presenting the current state of knowledge based on the personal experience of the authors and the current state of published research in one particular area of food processing While the main focus is on processing the physical principles and the chemical and microbiological basis of the process are also covered plus the impact of the technology on the quality and safety of food This book presents a comprehensive and fully up to date reference on the principles and applications of microwave processing of food products Modeling Food Processing Operations Serafim Bakalis,Kai Knoerzer,Peter J Fryer,2015-04-28

Computational modeling is an important tool for understanding and improving food processing and manufacturing It is used for many different purposes including process design and process optimization However modeling goes beyond the process and can include applications to understand and optimize food storage and the food supply chain and to perform a life cycle analysis Modeling Food Processing Operations provides a comprehensive overview of the various applications of modeling in conventional food processing The needs of industry current practices and state of the art technologies are examined and case studies are provided Part One provides an introduction to the topic with a particular focus on modeling and simulation strategies in food processing operations Part Two reviews the modeling of various food processes involving heating and cooling These processes include thermal inactivation sterilization and pasteurization drying baking frying and chilled and frozen food processing storage and display Part Three examines the modeling of multiphase unit operations such as membrane separation extrusion processes and food digestion and reviews models used to optimize food distribution Comprehensively reviews the various applications of modeling in conventional food processing Examines the modeling of multiphase unit operations and various food processes involving heating and cooling Analyzes the models used to optimize food distribution Snack Foods Sergio O. Serna-Saldivar,2022-04-20 The diverse segments of the snack industries that generate close to 520 billion of annual sales are adapting to new consumer s expectations especially in terms of convenience flavor shelf life and nutritional and health claims Snack Foods Processing Innovation and Nutritional Aspects was conceptualized to thoroughly cover practical and scientific aspects related to the chemistry technology processing functionality quality control analysis and nutrition and health implications of the wide array of snacks derived from grains

fruits vegetables milk and meat poultry seafood This book focuses on novel topics influencing food product development like innovation new emerging technologies and the manufacturing of nutritious and health promoting snacks with a high processing efficiency The up to date chapters provide technical reviews emphasising flavored salty snacks commonly used as finger foods including popcorn wheat based products crispbreads pretzels crackers lime cooked maize snacks tortilla chips and corn chips extruded items expanded and half products or pellets potato chips peanuts almonds tree nuts and products derived from fruits vegetables milk animal and marine sources Key Features Describes traditional and novel processes and unit operations used for the industrial production of plant and animal based snacks Depicts major processes employed for the industrial production of raw materials oils flavorings and packaging materials used in snack food operations Contains relevant and updated information about quality control and nutritional attributes and health implications of snack foods Includes simple to understand flowcharts relevant information in tables and recent innovations and trends Divided into four sections Snack Foods aims to understand the role of the major unit operations used to process snacks like thermal processes including deep fat frying seasoning packaging and the emerging 3 D printing technology Moreover the book covers the processing and characteristics of the most relevant raw materials used in snack operations like cereal based refined grits starches and flours followed by chapters for oils seasoning formulations and packaging materials The third and most extensive part of the book is comprised of several chapters which describe the manufacturing and quality control of snacks mentioned above The fourth section is comprised of two chapters related to the nutritional and nutraceutical and health promoting properties of all classes of snacks discussed herein

Second Microgravity Fluid Physics Conference ,1994

Microfluidics and Nanofluidics Handbook Sushanta K. Mitra, Suman Chakraborty, 2011-09-20 This comprehensive handbook presents fundamental aspects fabrication techniques introductory materials on microbiology and chemistry measurement techniques and applications of microfluidics and nanofluidics The first volume of the handbook focuses on physics and transport phenomena along with life sciences and related applications It provides newcomers with the fundamental science background required for the study of microfluidics and nanofluidics In addition the advanced techniques and concepts described in the text will benefit experienced researchers and professionals *Transactions of the ASME*. ,2003-11

Food Process Engineering Explained Anagh Deshpande, 2024-12-15 Food Process Engineering Explained addresses the growing need for cleaner and healthier food in response to a rising population The book explores recent advancements in the food processing industry and technology covering production processing packaging storage and cooking techniques to ensure and preserve food quality taste and aesthetic value We provide extensively researched techniques processes and recent developments as well as the challenges faced by the food processing industry The book includes graphs charts tables and arithmetical problems to offer a comprehensive understanding of the various stages and parts of the food processing industry One unique feature of our book is its dual focus on both the scientific and economic aspects of food

processing By examining each process from these perspectives we offer insights into the economic impact of the industry
This book is perfect for anyone interested in delving deeper into food processing providing valuable knowledge about the
technologies and methods that drive the industry

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