

PARTICLE TECHNOLOGY SERIES

THE SCIENCE AND ENGINEERING OF GRANULATION PROCESSES

Jim Litster and Bryan Ennis

Springer-Science+Business Media, B.V.

Science And Engineering Of Granulation Processes

Khosrow-Pour D.B.A., Mehdi



Science And Engineering Of Granulation Processes:

The Science and Engineering of Granulation Processes Jim Litster, Bryan Ennis, 2013-06-29 This book had its origins in a meeting between two relatively young particle technology researchers on Rehoboth Beach in Delaware in 1992 near the holiday house of Reg Davies then Director of the Particle Science and Technology Research Center in Dupont As we played in the sand we shared an excitement for developments in particle technology especially particle characterization that would lead operations such as granulation to be placed on a sound scientific and engineering footing The immediate outcome from this interaction was the development of new industry short courses in granulation and related topics which we taught together both in Australia and North America This book follows closely the structure and approaches developed in these courses particularly the emphasis on particle design in granulation where the impact of both formulation properties and process variables on product attributes needs to be understood and quantified The book has been a long time in the making We have been actively preparing the book for at least five years Although the chapters have relatively good bibliographies this book is not a review of the field Rather it is an attempt by the authors to present a comprehensive engineering approach to granulator design scale up and operation It is exciting for us to see the explosion of research interest around the world in this area in the last five to seven years Some of the most recent work will have to find its way into the second edition

Granularity in Materials Science George Kyzas, Athanasios C. Mitropoulos, 2018-10-24 Granular materials are a special topic of recent research and are a milestone of science and technology These materials are very simple they are large conglomerations of discrete macroscopic particles Granular materials have a broad area of development which is growing rapidly day by day Their impact on commercial applications and academia and education is huge The basic points of this book are the important applications and properties of granular materials For example special mention is made of rheological points shapes and civil engineering aspects *Production, Handling and Characterization of Particulate Materials* Henk G. Merkus, Gabriel M.H. Meesters, 2015-11-26 This edited volume presents most techniques and methods that have been developed by material scientists chemists chemical engineers and physicists for the commercial production of particulate materials ranging from the millimeter to the nanometer scale The scope includes the physical and chemical background experimental optimization of equipment and procedures as well as an outlook on future methods The book addresses issues of industrial importance such as specifications control parameters control strategy process models energy consumption and discusses the various techniques in relation to potential applications In addition to the production processes all major unit operations and characterization methods are described in this book It differs from other books which are devoted to a single technique or a single material Contributors to this book are acknowledged experts in their field The aim of the book is to facilitate comparison of the different unit operations leading to optimum equipment choices for the production handling and storage of particulate materials An advantage of this approach is that unit operations that are common in one field of

application are made accessible to other fields The overall focus is on industrial application and the book includes some concrete examples The book is an essential resource for students or researchers who work in collaboration with manufacturing industries or who are planning to make the switch from academia to industry

Design and Processing of Particulate Products Jim Litster, 2016-10-20 With this unique and comprehensive text readers will gain the quantitative tools needed to engineer the particulate processes and products that are ubiquitous in modern life Covering a series of particle and particulate delivery form design processes with emphasis on design and operation to control particle attributes and supported by many worked examples it is essential reading for students and practitioners Topics covered include a range of particle design processes such as crystallization and precipitation granulation grinding aerosol processes and spray drying as well as forms of delivery such as granules tablets dry powders and aerosols Readers will learn from real world examples how the primary particle properties and the structure and properties of the delivery form can lead to high performance products ranging from pharmaceuticals consumer goods and foods to specialty chemicals paints agricultural chemicals and minerals

Continuous Manufacturing of Pharmaceuticals Peter Kleinebudde, Johannes Khinast, Jukka Rantanen, 2024-10-28 A comprehensive look at existing technologies and processes for continuous manufacturing of pharmaceuticals As rising costs outpace new drug development the pharmaceutical industry has come under intense pressure to improve the efficiency of its manufacturing processes Continuous process manufacturing provides a proven solution Among its many benefits are minimized waste energy consumption and raw material use the accelerated introduction of new drugs the use of smaller production facilities with lower building and capital costs the ability to monitor drug quality on a continuous basis and enhanced process reliability and flexibility Continuous Manufacturing of Pharmaceuticals prepares professionals to take advantage of that exciting new approach to improving drug manufacturing efficiency This book covers key aspects of the continuous manufacturing of pharmaceuticals The first part provides an overview of key chemical engineering principles and the current regulatory environment The second covers existing technologies for manufacturing both small molecule based products and protein peptide products The following section is devoted to process analytical tools for continuously operating manufacturing environments The final two sections treat the integration of several individual parts of processing into fully operating continuous process systems and summarize state of art approaches for innovative new manufacturing principles Brings together the essential know how for anyone working in drug manufacturing as well as chemical food and pharmaceutical scientists working on continuous processing Covers chemical engineering principles regulatory aspects primary and secondary manufacturing process analytical technology and quality by design Contains contributions from researchers in leading pharmaceutical companies the FDA and academic institutions Offers an extremely well informed look at the most promising future approaches to continuous manufacturing of innovative pharmaceutical products Timely comprehensive and authoritative Continuous Manufacturing of Pharmaceuticals

is an important professional resource for researchers in industry and academe working in the fields of pharmaceuticals development and manufacturing

Pharmaceutical Blending and Mixing P. J. Cullen, Rodolfo J. Románach, Nicolas Abatzoglou, Chris D. Rielly, 2015-07-20 Written in four parts this book provides a dedicated and in depth reference for blending within the pharmaceutical manufacturing industry It links the science of blending with regulatory requirements associated with pharmaceutical manufacture The contributors are a combination of leading academic and industrial experts who provide an informed and industrially relevant perspective of the topic This is an essential book for the pharmaceutical manufacturing industry and related academic researchers in pharmaceutical science and chemical and mechanical engineering

Predictive Modeling of Pharmaceutical Unit Operations Preetanshu Pandey, Rahul Bharadwaj, 2016-09-26 The use of modeling and simulation tools is rapidly gaining prominence in the pharmaceutical industry covering a wide range of applications This book focuses on modeling and simulation tools as they pertain to drug product manufacturing processes although similar principles and tools may apply to many other areas Modeling tools can improve fundamental process understanding and provide valuable insights into the manufacturing processes which can result in significant process improvements and cost savings With FDA mandating the use of Quality by Design QbD principles during manufacturing reliable modeling techniques can help to alleviate the costs associated with such efforts and be used to create in silico formulation and process design space This book is geared toward detailing modeling techniques that are utilized for the various unit operations during drug product manufacturing By way of examples that include case studies various modeling principles are explained for the nonexpert end users A discussion on the role of modeling in quality risk management for manufacturing and application of modeling for continuous manufacturing and biologics is also included Explains the commonly used modeling and simulation tools Details the modeling of various unit operations commonly utilized in solid dosage drug product manufacturing Practical examples of the application of modeling tools through case studies Discussion of modeling techniques used for a risk based approach to regulatory filings Explores the usage of modeling in upcoming areas such as continuous manufacturing and biologics manufacturing

Bullet points

Modelling Batch Systems Using Population Balances , Process Technology André B. de Haan, Johan T. Padding, 2022-03-07 The book provides a general overview about process technology It focuses on the structure and development of production processes main technological operations and some important aspects of process economics For the technological operations the authors emphasize operating principles reasons for application and available industrial equipment

Dynamic Flowsheet Simulation of Solids Processes Stefan Heinrich, 2020-06-20 This book presents the latest advances in flowsheet simulation of solids processes focusing on the dynamic behaviour of systems with interconnected solids processing units but also covering stationary simulation The book includes the modelling of solids processing units for example for comminution sifting and particle formulation and also for reaction systems Furthermore it examines new approaches for the description of solids and

their property distributions and for the mathematical treatment of flowsheets with multivariate population balances

Encyclopedia of Information Science and Technology, Fifth Edition Khosrow-Pour D.B.A., Mehdi, 2020-07-24 The rise of intelligence and computation within technology has created an eruption of potential applications in numerous professional industries. Techniques such as data analysis, cloud computing, machine learning, and others have altered the traditional processes of various disciplines including healthcare, economics, transportation, and politics. Information technology in today's world is beginning to uncover opportunities for experts in these fields that they are not yet aware of. The exposure of specific instances in which these devices are being implemented will assist other specialists in how to successfully utilize these transformative tools with the appropriate amount of discretion, safety, and awareness. Considering the level of diverse uses and practices throughout the globe, the fifth edition of the Encyclopedia of Information Science and Technology series continues the enduring legacy set forth by its predecessors as a premier reference that contributes the most cutting edge concepts and methodologies to the research community. The Encyclopedia of Information Science and Technology Fifth Edition is a three volume set that includes 136 original and previously unpublished research chapters that present multidisciplinary research and expert insights into new methods and processes for understanding modern technological tools and their applications, as well as emerging theories and ethical controversies surrounding the field of information science. Highlighting a wide range of topics such as natural language processing, decision support systems, and electronic government, this book offers strategies for implementing smart devices and analytics into various professional disciplines. The techniques discussed in this publication are ideal for IT professionals, developers, computer scientists, practitioners, managers, policymakers, engineers, data analysts, and programmers seeking to understand the latest developments within this field and who are looking to apply new tools and policies in their practice. Additionally, academicians, researchers, and students in fields that include but are not limited to software engineering, cybersecurity, information technology, media, and communications, urban planning, computer science, healthcare, economics, environmental science, data management, and political science will benefit from the extensive knowledge compiled within this publication.

A Text Book of Pharmaceutics for I Year Diploma in Pharmacy Dr. Sowjanya Gurugubelli, Mrs. Jhansipriya Marabathuni V, Mr. Prakash Nathaniel Kumar Sarella, Mrs. Vinny Therissa Mangam, Mr. Shaikh Samir Karim Karim, Mrs. Chollangi Bharghavi, Mrs. Prathyusha Vuddanda, Dr. Bala Venkata Sivaram Nallamolu, Mrs. Vijayalakshmi M K, Mr. Anilkumar Vadaga, 2024-10-15 A Textbook of Pharmaceutics for I Year Diploma in Pharmacy is a comprehensive guide designed to provide students with a strong foundation in pharmaceutical sciences. This book covers a wide range of topics from the historical background of pharmacy to modern manufacturing techniques and novel drug delivery systems. Each chapter includes learning objectives, multiple choice questions, quick summaries, and important questions to reinforce key concepts. With its focus on both theoretical knowledge and practical applications, this textbook is an essential resource for aspiring pharmacists. It offers a balanced approach to understanding

the principles of pharmaceuticals quality control and the latest advancements in the field preparing students for successful careers in pharmacy Handbook of Food Powders Bhesh Bhandari,Nidhi Bansal,Min Zhang,Pierre Schuck,2023-11-11 Handbook of Food Powders Chemistry and Technology Second Edition covers current developments in food powder technology such as Microbial decontamination of food powders Gas and oil encapsulated powders and Plant based protein powders among other important topics Sections introduce processing and handling technologies for food powders focus on powder properties including surface composition rehydration and techniques to analyze the particle size of food powders and highlight specialty food powders such as dairy powders fruit and vegetable powders and coating foods with powders Edited by a team of international experts in the field this book continues to be the only quality reference on food powder technology available for the audiences of professionals in the food powder production and handling industries It is also ideal for development and quality control professionals in the food industry who use powders in foods and for researchers scientists and academics interested in the field Introduces six new chapters that incorporate the current developments in food powder technology Examines powder properties including surface composition shelf life and techniques used to examine particle size Focuses on specialty powders such as dairy infant formulas powdered egg fruit and vegetable and culinary and specialty products Nanomaterials and Nanocomposites, Nanostructure Surfaces, and Their Applications Olena Fesenko,Leonid Yatsenko,2023-03-27 This book highlights some of the latest advances in nanotechnology and nanomaterials from leading researchers in Ukraine Europe and beyond It features contributions presented at the 8th International Science and Practice Conference Nanotechnology and Nanomaterials NANO2020 which was held on August 25 28 2021 at Lviv Polytechnic National University and was jointly organized by the Institute of Physics the National Academy of Sciences of Ukraine Lviv Polytechnic National University University of Tartu Estonia University of Turin Italy Pierre and Marie Curie University France European Profiles S A Greece Representation of the Polish Academy of Sciences in Kyiv University of Angers France Ruprecht Karl University of Heidelberg Germany Internationally recognized experts from a wide range of universities and research institutions share their knowledge and key findings on material properties behavior and synthesis This book's companion volume also addresses topics such as nano optics energy storage and biomedical applications **Dynamic Process Modeling** ,2013-10-02 Inspired by the leading authority in the field the Centre for Process Systems Engineering at Imperial College London this book includes theoretical developments algorithms methodologies and tools in process systems engineering and applications from the chemical energy molecular biomedical and other areas It spans a whole range of length scales seen in manufacturing industries from molecular and nanoscale phenomena to enterprise wide optimization and control As such this will appeal to a broad readership since the topic applies not only to all technical processes but also due to the interdisciplinary expertise required to solve the challenge The ultimate reference work for years to come

Advances in Computer Science for Engineering and Education IV Zhengbing Hu,Sergey Petoukhov,Ivan

Dychka,Matthew He,2021-07-21 This book comprises high quality refereed research papers presented at the Fourth International Conference on Computer Science Engineering and Education Applications ICCSEEA2021 held in Kyiv Ukraine on January 23 24 2021 organized jointly by the National Technical University of Ukraine Igor Sikorsky Kyiv Polytechnic Institute National Aviation University and the International Research Association of Modern Education and Computer Science The topics discussed in the book include state of the art papers in computer science artificial intelligence engineering techniques genetic coding systems deep learning with its medical applications and knowledge representation with its applications in education It is an excellent source of references for researchers graduate students engineers management practitioners and undergraduate students interested in computer science and their applications in engineering and education

Continuous Pharmaceutical Processing and Process Analytical Technology Ajit S. Narang,Atul Dubey,2023-03-01 Continuous manufacturing of pharmaceuticals including aspects of modern process development is highlighted in this book with both the why and the how emphasizing process modeling and process analytical technologies Presenting specific case studies and drawing upon extensive experience from industry and academic opinion leaders this book focuses on the practical aspects of continuous manufacturing It gives the readers the strategic perspective and technical depth needed to adopt and implement these technologies where appropriate in order to gain the competitive edge in speed agility and reliability Features Discusses scientific solutions and process analytical technology to enable continuous manufacturing in the development of new drugs Includes short stories about how some companies have adopted CM and what their drivers were and what benefits were realized Addresses economic and practical considerations unlike many other technical books Emphasizes the practical aspects to give the reader the strategic imperative and technological depth to adopt and implement these technologies Highlights the why and the how focusing on the need analysis and process modeling and process analytical technologies

Applied AI Techniques in the Process Industry Chang He,Jingzheng Ren,2025-03-03 Thorough discussion of data driven and first principles models for energy relevant systems and processes approached through various in depth case studies Applied AI Techniques in the Process Industry identifies and categorizes the various hybrid models available that integrate data driven models for energy relevant systems and processes with different forms of process knowledge and domain expertise State of the art techniques such as reduced order modeling sparse identification and physics informed neural networks are comprehensively summarized along with their benefits such as improved interpretability and predictive power Numerous in depth case studies regarding the covered models and methods for data driven modeling process optimization and machine learning are presented from screening high performance ionic liquids and AI assisted drug design to designing heat exchangers with physics informed deep learning Edited by two highly qualified academics and contributed to by a number of leading experts in the field Applied AI Techniques in the Process Industry includes information on Integration of observed data and reaction mechanisms in deep learning for designing sustainable

glycolic acid Machine learning aided rational screening of task specific ionic liquids and AI for property modeling and solvent tailoring Integration of incomplete prior knowledge into data driven inferential sensor models under the variational Bayesian framework AI aided high throughput screening optimistic design of MOF materials for adsorptive gas separation and reduced order modeling and optimization of cooling tower systems Surrogate modeling for accelerating optimization of complex systems in chemical engineering Applied AI Techniques in the Process Industry is an essential reference on the subject for process chemical and pharmaceutical engineers seeking to improve physical interpretability in data driven models to enable usage that scales with a system and reduce inaccuracies and mismatch issues **Granulation and granulation processes**

Jiliang Xia, Elli Nurminen, 2006 **Chemical Engineering in the Pharmaceutical Industry** Mary T. am Ende, David J. am Ende, 2019-04-09 A guide to the important chemical engineering concepts for the development of new drugs revised second edition The revised and updated second edition of Chemical Engineering in the Pharmaceutical Industry offers a guide to the experimental and computational methods related to drug product design and development The second edition has been greatly expanded and covers a range of topics related to formulation design and process development of drug products The authors review basic analytics for quantitation of drug product quality attributes such as potency purity content uniformity and dissolution that are addressed with consideration of the applied statistics process analytical technology and process control The 2nd Edition is divided into two separate books 1 Active Pharmaceutical Ingredients API s and 2 Drug Product Design Development and Modeling The contributors explore technology transfer and scale up of batch processes that are exemplified experimentally and computationally Written for engineers working in the field the book examines in silico process modeling tools that streamline experimental screening approaches In addition the authors discuss the emerging field of continuous drug product manufacturing This revised second edition Contains 21 new or revised chapters including chapters on quality by design computational approaches for drug product modeling process design with PAT and process control engineering challenges and solutions Covers chemistry and engineering activities related to dosage form design and process development and scale up Offers analytical methods and applied statistics that highlight drug product quality attributes as design features Presents updated and new example calculations and associated solutions Includes contributions from leading experts in the field Written for pharmaceutical engineers chemical engineers undergraduate and graduation students and professionals in the field of pharmaceutical sciences and manufacturing Chemical Engineering in the Pharmaceutical Industry Second Edition contains information designed to be of use from the engineer s perspective and spans information from solid to semi solid to lyophilized drug products

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