



# Particulate Science and Technology

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# Particulate Technology

**Richard Holdich**



## **Particulate Technology:**

*Introduction to Particle Technology* Martin J. Rhodes, 2008-06-09 Particle technology is a term used to refer to the science and technology related to the handling and processing of particles and powders. The production of particulate materials with controlled properties tailored to subsequent processing and applications is of major interest to a wide range of industries including chemical and process food, pharmaceuticals, minerals and metals companies, and the handling of particles in gas and liquid solutions is a key technological step in chemical engineering. This textbook provides an excellent introduction to particle technology with worked examples and exercises. Based on feedback from students and practitioners worldwide, it has been newly edited and contains new chapters on slurry transport, colloids and fine particles, size enlargement, and the health effects of fine powders. Topics covered include: Characterization, Size Analysis, Processing, Granulation, Fluidization, Particle Formation, Granulation, Size Reduction, Storage and Transport, Hopper Design, Pneumatic Conveying, Standpipes, Slurry Flow, Separation, Filtration, Settling, Cyclones, Safety, Fire and Explosion Hazards, Health Hazards, Engineering the Properties of Particulate Systems, Colloids, Respirable Drugs, Slurry Rheology. This book is essential reading for undergraduate students of chemical engineering on particle technology courses. It is also valuable supplementary reading for students in other branches of engineering, applied chemistry, physics, pharmaceuticals, mineral processing, and metallurgy. Practitioners in industries in which powders are handled and processed may find it a useful starting point for gaining an understanding of the behavior of particles and powders. Review of the First Edition taken from *High Temperatures High pressures* 1999 31 243 251. This is a modern textbook that presents clear cut knowledge. It can be successfully used both for teaching particle technology at universities and for individual study of engineering problems in powder processing.

**Introduction to Particle Technology** Martin J. Rhodes, Jonathan Seville, 2024-05-16 INTRODUCTION TO PARTICLE TECHNOLOGY A new edition of the indispensable guide to particulates and powders. Particle technology concerns the formation, processing, and properties of the particles and powders which make up many of the products that surround us. Such products range from the cement and aggregate in the built environment to pharmaceuticals and processed foods. Most of the process industries involve particles either as essential components such as catalysts or as intermediate or final products, and minerals such as the rare earths that are generally mined and processed in particulate form. Particles can have many beneficial uses but they can also cause harm in the environment and through inhalation to the individual. In all cases the powder properties, particularly particle size, are crucially important. This well known textbook, now in its 3rd edition, provides an easily understood introduction to the underlying scientific principles of particle technology, together with examples of how these principles can be used in practical design and operation of industrial processes. Each chapter contains both worked examples and exercises for the student. Based on feedback from students and users of the earlier editions, this revised and expanded text includes introductory chapters on particles as products and on computational methods. The topics have been

selected to give coverage of the broad areas of particle technology and include Characterization size analysis surface area Processing granulation fluidization Particle formation granulation crystallisation tableting size reduction Storage and transport hopper design pneumatic conveying standpipes Separation filtration settling cyclones Safety fire and explosion hazards health hazards Engineering the properties of particulate systems to achieve desired product performance Discrete element modelling of particulate systems Introduction to Particle Technology 3rd Edition is essential reading for students of chemical engineering The text is also recommended reading for students of mechanical engineering applied chemistry pharmaceuticals physics mineral processing and metallurgy and is an excellent source for practising engineers and scientists looking to establish a working knowledge of the subject      *Particulate Technology* Clyde Orr,1966      *Particulate Technology for Delivery of Therapeutics* Sougata Jana,Subrata Jana,2017-10-09 The book focuses on novel particulate technologies for the purpose of drug delivery to humans Nowadays macro and nano scale particles are being investigated for targeted delivery of small and large biological macromolecules The targeting of drugs can minimize the dosage regimen and reduces dose related potential toxicity of drug molecules which in turn lead to increased potential compliance Various types of organic inorganic and polymer particles are currently being investigated These are attracting the attention of the research workers in the field of drug delivery science and technology This book covers polymersomes inorganic organic composites gold nanoparticles biopolymer and synthetic polymer particles etc All aspects of drug delivery in relation to each technology have been described including these advances Easy to read and understand the content of each chapter Rich in up to date information regarding their application      Fundamentals of Particle Technology Richard Holdich,2020-12-01 Fundamentals of Particle Technology is designed to assist the understanding of how particulate materials behave during processing and is written with engineers and scientists who are new to the subject in mind It is accessible in both cost and style and is illustrated with numerous line diagrams Most of the 16 chapters end with questions in multiple choice format This helps problem decomposition and the reader can see each step required to arrive at an overall process solution If the reader makes a mistake with any of the steps he or she usually does not see their answer and will immediately know where they have gone wrong The aspects of Particle Technology covered include particle characterisation solid liquid and solid gas separations fluidisation flow of and in dispersions powder mixing storage hazards crushing and colloidal interaction Extensive Internet support and referencing is provided The teaching style adopted is the result of experience gained from presenting the subject for over 30 years at both undergraduate and postgraduate level      **Particle Technology and Applications** Sunggyu Lee,Kimberly H. Henthorn,2012-03-26 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 chemical processes and novel functional materials With peer reviewed chapters written by a select group of

academic and industry experts the book provides examples of particle technology and its advanced industrial applications It includes the necessary scientific background of particle technology as well as relevant technological details of the application areas This helps readers grasp specific details of the applied technology since the advanced particle technology can directly or synergistically have an impact on outcomes such as the development of a targeted functional material enhancement of existing processing techniques and modification of the properties of existing materials Presenting a consistent scientific treatment of all topics this comprehensive yet accessible book covers a variety of practical applications and relevant theoretical foundation of particle science and technology It will help readers tackle new challenges in process and product development and create new methodologies in the clean technology sector

### **Particle Technology and Engineering**

Jonathan P.K. Seville, Chuan-Yu Wu, 2016-05-20 Particle Technology and Engineering presents the basic knowledge and fundamental concepts that are needed by engineers dealing with particles and powders The book provides a comprehensive reference and introduction to the topic ranging from single particle characterization to bulk powder properties from particle particle interaction to particle fluid interaction from fundamental mechanics to advanced computational mechanics for particle and powder systems The content focuses on fundamental concepts mechanistic analysis and computational approaches The first six chapters present basic information on properties of single particles and powder systems and their characterisation covering the fundamental characteristics of bulk solids powders and building an understanding of density surface area porosity and flow as well as particle fluid interactions gas solid and liquid solid systems with applications in fluidization and pneumatic conveying The last four chapters have an emphasis on the mechanics of particle and powder systems including the mechanical behaviour of powder systems during storage and flow contact mechanics of particles discrete element methods for modelling particle systems and finite element methods for analysing powder systems This thorough guide is beneficial to undergraduates in chemical and other types of engineering to chemical and process engineers in industry and early stage researchers It also provides a reference to experienced researchers on mathematical and mechanistic analysis of particulate systems and on advanced computational methods Provides a simple introduction to core topics in particle technology characterisation of particles and powders interaction between particles gases and liquids and some useful examples of gas solid and liquid solid systems Introduces the principles and applications of two useful computational approaches discrete element modelling and finite element modelling Enables engineers to build their knowledge and skills and to enhance their mechanistic understanding of particulate systems

**Particle Characterization in Technology** J.K. Beddow, 2018-01-18 The first section of volume II deals with both theory and methods of morphological analysis it then discusses data analysis and finally the applications

**Processing of Particulate Solids** J.P.

Seville, Ugamaur Tüzün, R. Clift, 2012-12-06 Over half of the products of the chemical and process industries are sold in a particulate form The range of such products is vast from agrochemicals to pigments from detergents to foods from plastics to

pharmaceuticals However surveys of the performance of processes designed to produce particulate products have consistently shown inadequate design and poor reliability Particle technology is a new subject facing new challenges Chemical and process engineering is becoming less concerned with the design of plants to produce generic simple chemicals which are often single phase fluids and is now more concerned with speciality effect chemicals which may often be in particulate form Chemical and process engineers are also being recruited in increasing numbers into areas outside their traditional fields such as the food industry pharmaceuticals and the manufacture of a wide variety of consumer products This book has been written to meet their needs It provides comprehensive coverage of the technology of particulate solids in a form which is both accessible and concise enough to be useful to engineering and science students in the final year of an undergraduate degree and at Master s level Although it was written with students of chemical engineering in mind it will also be of use and interest to students of other disciplines It comprises an account of the fundamentals of the subject illustrated by worked examples and followed by a wide range of selected applications

**Particle Characterization in Technology** John Keith Beddow, 2018-01-18 Volume I present an important exposition of some of the most significant areas where particle characterization is applied The technological fields include pharmaceutical materials bulk solids and explosions

**Particle Technology** Hans Rumpf, 2012-12-06 The inspiration for translating this classic text came during a sabbatical year spent at the University of Karlsruhe in 1974 Under the leadership of the late Professor Hans Rumpf the Institut für Mechanische Verfahrenstechnik Karlsruhe from the early 1960s onwards by extensive research and advanced teaching had promoted the discipline of mechanical process technology a branch of process engineering which had been rather neglected especially in many chemical engineering departments of universities in the English speaking world There is a need for texts of this kind particularly for the more specialized teaching that has to be done during the later stages of engineering courses This work which is really a monograph serves as a concise and compact introduction albeit at an advanced level to all those functions of process engineering that have to do with the handling and treatment of particulate matter and bulk solids Much of this information has previously been scattered around journals and other books and not brought together in one work Furthermore Rumpf has emphasized the physical and theoretical foundations of the subject and avoided a treatment that is simply empirical

**Processing of Particulate Solids** J. P. Seville, Ugam Tuzun, R. Clift, 1997-06-30 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

**Advances in Particulate Technology**, 1986 Current Awareness in Particle Technology, 1987 **Particulate Science and Technology** John K. Beddow, 1980 Contents Preface Introduction Chapter 1 In the Scheme of Things 3 1 1 Particulate Science and Technology 31 2 Our Realm 5 Chapter 2 The Single Particle 10 2 1 The Primacy of the Single Particle 102 2 Concept and Definition of a Particle 132 3 The Particle Surface 352 4 The Subsurface Region 502 5 Interior of the Particle 582 6 Particle Size 592 7 Conception and Definitions of Shape 62 Chapter 3 The Formation and Production of Particulates 77 3 1 The Several Processes 773 2 Atomization of Metal Powders 793 3 Spraying and Atomizing 833 4 Comminution 983 5 Crystallization 1303 6 Production of Fine Powders 1353 7 Granulation 1363 8 Aerosol Particle Generation 1503 9 Ultrasmall Particles and Clusters 154 Chapter 4 The Processing and Handling of Particulate Matter 167 4 1 Current State of the Art 1674 2 Flow and Storage of Particulate Solids 1694 3 Conveyance and Flow of Particulate Solids 1884 4 Particulate Beds 2044 5 Mixing of Particulate Solids 2154 6 Solid Liquid Mixing 2384 7 Interparticle Separation Technology 2424 8 Laboratory Separation Techniques 2514 9 Particle Fluid Separation 2554 10 Compaction of Particulate Matter 2794 11 Sintering 291 Chapter 5 Description of Particulate Assemblies 311 5 1 Description of Particle Sets 3115 2 Properties of Particle and Particle Sets as Influenced by Variations in Particle Size and Particle Shape 3135 3 Fundamental Statistical Concepts 3285 4 Mean Diameters 3345 5 Shape Factors 3385 6 Distribution Functions and Functional Model 3505 7 Test of Statistical Hypothesis Statistical Inference 3565 8 Particle Size Data Types I and II 3585 9 Calculation of Sample Statistics and Data Comparison Finite Interval Model 3595 10 Summary of Methods for Finite Interval Data 3645 11 General Types of Log Normal Functions 3665 12 Comparison of Sample Statistics Log Normal Model 3695 13 Surface Area and Specific Surface Calculations 3725 14 Other Distributions 3735 15 Chapter Notations and Definitions 377 Chapter 6 Fine Particle Characterization 387 6 1 From Past to Future 3876 2 Size Analysis and Sampling 3896 3 Fundamentals of Methods for Determining Particle Size 4026 4 Principles of Shape Determination Methods 4136 5 Pattern Recognition and Particulate Characterization 4286 6 On the Design of a System for Particle Shape Analysis 4366 7 Feature Extraction 4546 8 Particle Signature and the Meloy Equations 4666 9 Property Representation 4826 10 Principles of Stereology 4986 11 Deterministic Statistical and Fuzzy Classifiers 5046 12 Interpretation of Coefficients 524 Chapter 7

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**Technology and Engineering** Jonathan Seville, Chuan-Yu Wu, 2016 Particle Technology and Engineering presents the basic knowledge and fundamental concepts that are needed by engineers dealing with particles and powders The book provides a comprehensive reference and introduction to the topic ranging from single particle characterization to bulk powder properties from particle particle interaction to particle fluid interaction from fundamental mechanics to advanced computational mechanics for particle and powder systems The content focuses on fundamental concepts mechanistic analysis and computational approaches The first six chapters present basic information on properties of single particles and powder systems and their characterisation covering the fundamental characteristics of bulk solids powders and building an understanding of density surface area porosity and flow as well as particle fluid interactions gas solid and liquid solid systems with applications in fluidization and pneumatic conveying The last four chapters have an emphasis on the mechanics of particle and powder systems including the mechanical behaviour of powder systems during storage and flow contact mechanics of particles discrete element methods for modelling particle systems and finite element methods for analysing powder systems This thorough guide is beneficial to undergraduates in chemical and other types of engineering to chemical and process engineers in industry and early stage researchers It also provides a reference to experienced researchers on mathematical and mechanistic analysis of particulate systems and on advanced computational methods Provides a simple introduction to core topics in particle technology characterisation of particles and powders interaction between particles gases and liquids and some useful examples of gas solid and liquid solid systems Introduces the principles and applications of two useful computational approaches discrete element modelling and finite element modelling Enables engineers to build their knowledge and skills and to enhance their mechanistic understanding of particulate systems      *Particulate Technology*, 1979      *Particulate Products* Henk G. Merkus, Gabriel M.H. Meesters, 2013-11-19 Particulate products make up around 80% of chemical products from all industry sectors Examples given in this book include the construction materials fine ceramics and concrete the delicacies chocolate and ice cream pharmaceutical powders medical inhalers and sun screen liquid and powder paints Size distribution and the shape of the particles provide for different functionalities in these products Some functions are general others specific General functions are powder flow and require at the typical particulate concentrations of these products that the particles cause adequate rheological behavior during processing and or for product performance Therefore this book addresses particle packing as well as its relation to powder flow and rheological behavior Moreover



general relationships to particle size are discussed for e g color and sensorial aspects of particulate products Product specific functionalities are often relevant for comparable product groups Particle size distribution and shape provide for example the following functionalities dense particle packing in relation to sufficient strength is required in concrete construction ceramic objects and pharmaceutical tablets good sensorial properties mouthfeel to chocolate and ice cream effective dissolution flow and compression properties for pharmaceutical powders adequate hiding power and effective coloring of paints for protection and the desired esthetical appeal of the objects adequate protection of our body against sun light by sunscreen effective particle transport and deposition to desired locations for medical inhalers and powder paints Adequate particle size distribution shape and porosity of particulate products have to be achieved in order to reach optimum product performance This requires adequate management of design and development as well as sufficient knowledge of the underlying principles of physics and chemistry Moreover flammability explosivity and other health hazards from powders during handling are taken into account This is necessary since great risks may be involved In all aspects the most relevant parameters of the size distribution and particle shape have to be selected In this book experts in the different product fields have contributed to the product chapters This provides optimum information on what particulate aspects are most relevant for behavior and performance within specified industrial products and how optimum results can be obtained It differs from other books in the way that the critical aspects of different products are reported so that similarities and differences can be identified We trust that this approach will lead to improved optimization in design development and quality of many particulate products

**Particulate Technology** Denver Research Institute,197?

## Enjoying the Song of Expression: An Emotional Symphony within **Particulate Technology**

In a world used by monitors and the ceaseless chatter of immediate transmission, the melodic splendor and emotional symphony produced by the prepared term often fade in to the back ground, eclipsed by the constant sound and interruptions that permeate our lives. Nevertheless, nestled within the pages of **Particulate Technology** a charming literary prize full of organic emotions, lies an immersive symphony waiting to be embraced. Crafted by an elegant musician of language, this charming masterpiece conducts readers on a psychological journey, well unraveling the hidden melodies and profound impact resonating within each cautiously crafted phrase. Within the depths of the moving review, we will discover the book is central harmonies, analyze their enthralling publishing design, and surrender ourselves to the profound resonance that echoes in the depths of readers souls.

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