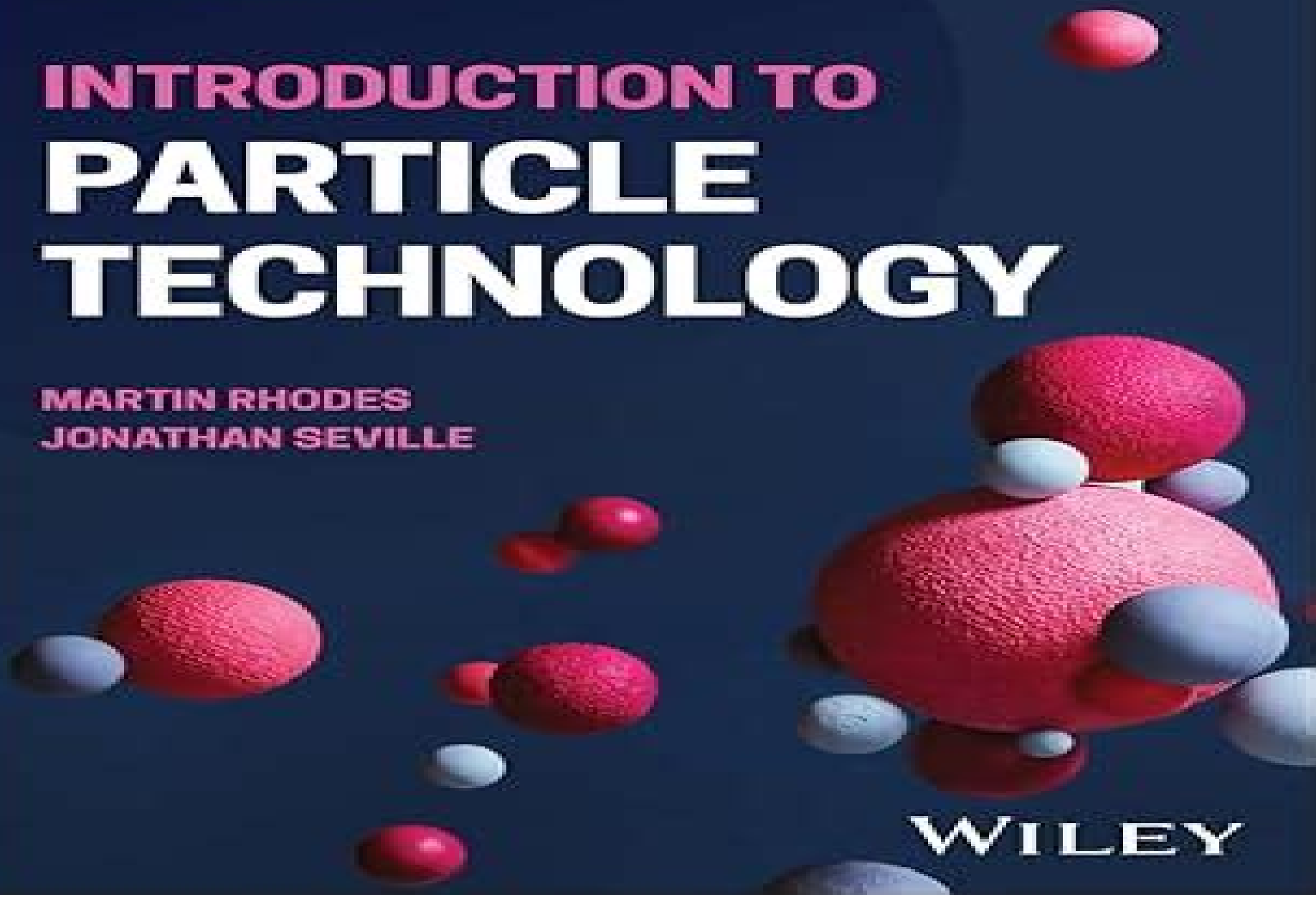


THIRD EDITION

INTRODUCTION TO PARTICLE TECHNOLOGY

**MARTIN RHODES
JONATHAN SEVILLE**

WILEY



Particle Technology

Enrique Ortega-Rivas



Particle Technology:

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.

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. 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

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 fUr 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

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

Particle Technology and Applications Sunggyu Lee, Kimberly H. Henthorn, 2016-04-19 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

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 Technology and Textiles Jean Cornier, Franz Pursche, 2023-05-22 Functionalization of material systems is one of the key developments nowadays in the textile industry where particles are frequently used to enhance the properties of fibers and to add new functionalities This book focuses on innovative textile materials and is a perfect guide for professionals in the textile industry and scientists alike An overview of particle technology is provided before addressing all topics relevant to particle enhanced textiles i e the properties and application of micro nanoparticles in textiles production techniques safety as well as regulatory and intellectual property aspects The book covers the composition and applications of various types of textile fillers finishings and microfibers gives an outlook on future trends and challenges in the research development and production of nano and micro enabled textiles The authors of the book who are leading experts in their fields address many aspects relevant to the use of particle enhanced textiles in industrial applications as well as in our daily life A particular emphasis is put on practical examples of applications and products safety and sustainability issues and the potential for further innovation This book should bring inspiration for textile scientists in using particles for improving textiles and further expanding their possibilities of use Powtech '83 Particle Technology Sam Stuart, 2013-10-22 Powtech 83 Particle Technology focuses on the techniques and processes involved in the handling and processing of powders and other related products The book presents studies that show the composition characteristics value and strength of materials when subjected to different conditions in different environments Divided into five parts with 32 chapters the book features the work of contributors who have conducted research on the composition and chemical processes involved in particle technology The pieces that are presented feature experiments and tests conducted on different materials such as coal and liquids These experiments are supported by lengthy discussions coupled with numerical representation to validate the claims of authors in their respective concerns Although the authors have their own topics to cover they will manage to capture the interest of physicists chemists and mechanical and civil engineers who are interested in particle technology Taking into consideration the value of information presented in the book these professionals will find the book a reliable source of data in their profession and in their studies

Superfine Particle Technology Noboru Ichinose, Yoshiharu Ozaki, Seiichiro Kashu, 2012-12-06 If a substance is repeatedly subdivided the result is what are known as microscopic particles These particles are distinguished from the solid mass which they originally formed by the size of the surface area per unit weight This simple difference holds true down to a certain lower size limit and when this limit is exceeded a new state of matter is reached in which the behavior of the particles is quite different to that of the original solid Particles in this state are termed superfine particles and are distinct from ordinary particles The size of the superfine particles that is to say the size limit below which particle behavior is completely different from the behavior of the original solid varies a good deal depending on the physical properties of the substance in question Properties such as magnetism and electrical resistance are closely related to the internal structural properties of

the particles themselves such as the magnetization processes of their respective magnetic domains and the mean free path of charged bodies This internal structure therefore limits the size of the superfine particles In ceramic processing on the other hand the surface area of the particles themselves becomes an even more important factor than their internal structure In this case the size of the superfine particles is determined by the interaction between water and solvents on the surface of the particles

Small Particles Technology Jan-Erik Otterstedt, Dale A. Brandreth, 2013-03-09 It is difficult to imagine modern technology without small particles 1 1000 nm in size because virtually every industry depends in some way on the use of such materials Catalysts printing inks paper dyes and pigments many medicinal products adsorbents thickening agents some adhesives clays and hundreds of other diverse products are based on or involve small particles in a very fundamental way In some cases finely divided materials occur naturally or are merely a convenient form for using a material In most cases small particles play a special role in technology because in effect they constitute a different state of matter because of the basic fact that the surface of a material is different from the interior by virtue of the unsaturated bonding interactions of the outermost layers of atoms at the surface of a solid Whereas in a macroscale particle these differences are often insignificant as the surface area per unit mass becomes larger by a factor of as much as 10 physical and chemical effects such as adsorption become so pronounced as to make the finely divided form of the bulk material into essentially a different material usually one that has no macroscale counterpart

Particulate Systems in Nano- and Biotechnologies Wolfgang Sigmund, Hassan El-Shall, Dinesh O. Shah, Brij M. Moudgil, 2008-12-22 Despite the widespread growth and acceptance of particulate technology challenges in the design operation and manufacturing of these systems still exist These critical issues must be resolved so that particle technology may continue to serve as a foundation for new nano and biotechnologies

Particulate Systems in Nano and Biotechnologies presented by *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

Particle Characterization: Light Scattering Methods Renliang Xu, 2001-11-30 Particle characterization is an important component in product research and development manufacture and quality control of particulate materials and an important tool in the frontier of sciences such as in biotechnology and nanotechnology This book systematically describes one major branch of modern particle characterization technology the light scattering methods This is the first monograph in particle science and technology covering the principles instrumentation data interpretation applications and latest experimental development in laser diffraction optical particle counting photon correlation spectroscopy and electrophoretic light scattering In addition a summary of all major particle sizing and other characterization methods basic statistics and sample preparation techniques used in particle characterization as well as almost 500 latest references are provided The book is a must for industrial users of light scattering techniques characterizing a variety of particulate systems and for undergraduate or graduate students who want to learn how to use light scattering to study particular materials in chemical engineering material sciences physical chemistry and other related fields

Functional Gradient Materials and Surface Layers Prepared by Fine Particles Technology

Marie-Isabelle Baraton, Irina V. Uvarova, 2001-03-31 The term functional gradient materials was coined in Japan in the 1980s to describe a class of materials having spatially homogenous microstructures and properties These materials can be used successfully in such applications as electronic devices optical films anti wear and anti corrosion coatings thermal barrier coatings and biomaterials The materials are fabricated with the use of nanoparticles leading to greatly improved performance Nanoparticle technology is not straightforward however demanding a modification of methods for processing and characterization This book provides graduate students postdoctoral fellows engineers and senior scientists with an in depth review of aspects of the field ranging from synthetic methods to a variety of applications The different approaches to

material synthesis are described giving the reader a better understanding of the complex phenomena involved. Characterization and the evaluation of properties are also discussed. *Instrumentation for Fluid Particle Flow* S.L. Soo, 1999-10-01. Some of the most original and productive research specialists in the field of particle fluid flow systems are assembled in this book which is an important and current reference volume. The book focuses on methods of measurement and options for engineers.

Unit Operations of Particulate Solids Enrique Ortega-Rivas, 2016-04-19. Suitable for practicing engineers and engineers in training, this book covers the most important operations involving particulate solids. Through clear explanations of theoretical principles and practical laboratory exercises, the text provides an understanding of the behavior of powders and pulverized systems. It also helps readers develop skills for operating, optimizing, and innovating particle processing technologies and machinery in order to carry out industrial operations. The author explores common bulk solids processing operations including milling, agglomeration, fluidization, mixing, and solid fluid separation.

Particle Size Analysis I. Claus Bernhardt, 2012-12-06. I, teacher Professor Ernst Joachim Ivers, to whom I still owe many insights 20 years after the end of his working life, this English edition is not an unedited translation of the German edition of 1990. The text has been substantially revised in some chapters taking into account the literature published in the mean time. I wish to thank Dr. Ing. H. Finken-Freiberg who has prepared the translation from German into English with deep scientific understanding and in close contact with the author. I also wish to express my gratitude to Chapman; it is the result of a scientific integration process taking place in many industrialized countries of the world. In recent years, the meaning and mutual connection of the related concepts as well as the tasks of the scientific disciplines designated by them have been the subject of intensive discussion, which, however, has not led to a generally accepted terminology.

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

Nanoparticle Technology Handbook Kiyoshi Nogi, Makio Naito, Toyokazu Yokoyama, 2012-04-13 This handbook explains aspects of nanoparticles with many application examples showing their advantages and advanced development

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