Supercritical Fluid Technology In Materials Science And Engineering Syntheses Properties And Applications

Retaining the comprehensive and in-depth approach that cemented the bestselling first edition's place as a standard reference in the field, the Handbook of Semiconductor Manufacturing Technology, Second Edition features new and updated material that keeps it at the vanguard of today's most dynamic and rapidly growing field. Iconic experts Robert Doering and Yoshio Nishi have again assembled a team of the world's leading specialists in every area of semiconductor manufacturing to provide the most reliable, authoritative, and industry-leading information available. Stay Current with the Latest Technologies In addition to updates to nearly every existing chapter, this edition features five entirely new contributions on... Silicon-on-insulator (SOI) materials and devices Supercritical CO2 in semiconductor cleaning Low-? dielectrics Atomic-layer deposition Damascene copper electroplating Effects of terrestrial radiation on integrated circuits (ICs) Reflecting rapid progress in many areas, several chapters were heavily revised and updated, and in some cases, rewritten to reflect rapid advances in such areas as interconnect technologies, gate dielectrics, photomask fabrication, IC packaging, and 300 mm wafer fabrication. While no book can be up-to-the-minute with the advances in the semiconductor field, the Handbook of Semiconductor Manufacturing Technology keeps the most important data, methods, tools, and techniques close at hand.

Supercritical Fluid Technology for Energy and Environmental Applications covers the fundamental principles involved in the preparation and characterization of supercritical fluids (SCFs) used in the energy production and other environmental applications. Energy production from diversified resources — including renewable materials — using clean processes can be accomplished using technologies like SCFs. This book is focused on critical issues scientists and engineers face in applying SCFs to energy production and environmental protection, the innovative solutions they have found, and the challenges they need to overcome. The book also covers the basics of sub- and supercritical fluids, like the thermodynamics of phase and chemical equilibria, mathematical modeling, and process calculations. A supercritical fluid is any substance at a temperature and pressure above its critical point where distinct liquid and gas phases do not exist. At this state the compound demonstrates unique properties, which can be "fine-tuned," making them suitable as organic solvents in a range of industrial and laboratory processes. This volume enables readers to select the most appropriate medium for a specific situation. It helps instructors prepare course material for graduate and postgraduate courses in the area of chemistry, chemical engineering, and environmental engineering. And it helps professional engineers learn supercritical fluid-based technologies and use them in solving the increasingly challenging environmental issues. Relates theory, chemical characteristics, and properties of the particular supercritical fluid to its various applications Covers the fundamentals of supercritical fluids, like thermodynamics of phase and chemical equilibria, mathematical modeling, and process calculations Includes the most recent applications of supercritical fluids, including energy generation, materials synthesis, and environmental protection

Thoroughly revised and expanded, the third edition of the Encyclopedia of Chromatography is an authoritative source of information for researchers in chemistry,

biology, physics, engineering, and materials science. This quick reference and guide to specific chromatographic techniques and theory provides a basic introduction to the science and techn

A novel apparatus and methods of controlled particle formation from supercritical fluids are proposed. A solution of the material of interest is fed together with a fluid (e.g. CO2) above its critical point through a concentric nozzle into a high pressure vessel. The temperature and pressure of the vessel are controlled by a thermocouple and an automated back pressure regulator respectively. The supercritical fluid disperses, mixes and rapidly extracts the solvent leading to formation of particulate products. The products are retained in the high pressure vessel by a particle retention device. The supercritical solution (i.e. the supercritical fluid and the solvent) emerging from the back pressure regulator is allowed to expand so that the solvent may separate from the gas, and both are recycled. By changing the working conditions of pressure, temperature and flow rate of the solution to the supercritical fluid, it is possible to control the size, shape and morphology of the products - increase of the pressure and/or flow rate of the supercritical fluid led to a decrease in particle size. Products prepared by this new technique include, drug materials, inorganics, polymers, carbohydrates and proteins. Microparticulate products of the drug salmeterol xinafoate exhibit narrow size distribution, batch-to-batch consistency, high degree of crystallinity, enhanced chemical and polymorphic purity, low dynamic bulk density, undetectable amounts of residual solvent content and are free flowing with low dispersion energy due to lack of static charge. This new method of preparation of particles from supercritical fluids has potential applicatlon to industrial particle formation processing avoiding problems of conventional crystallisation procedures.

This book systematically presents the technical aspects of supercritical water oxidation and supercritical water gasification for energy and environmental applications, which include reactor design, construction materials, corrosion, salt precipitation, etc. The book provides a comprehensive introduction to the properties of supercritical water, and the industrial applications, reaction mechanisms and reaction kinetics of supercritical water oxidation (SCWO) and supercritical water gasification (SCWG). The reactions occurring in supercritical water are complex, and studying their reaction mechanisms is of great importance for the development of supercritical water processing technologies. Accordingly, the book explains the oxidative mechanisms and kinetics of organic matter in supercritical water in detail. However, the harsh reaction conditions in supercritical water can easily create severe reactor corrosion and salt deposition problems. Therefore, the book also comprehensively reports on the mechanism analysis, state of research, and development trends regarding these two problems. Lastly, the book summarizes the development of supercritical water processing technologies, including studies on SCWO and SCWG, as well as near-zero-emission systems of pollutants based on SCWO technology. In short, the book provides a wealth of valuable information for all readers who are interested in using SCWO for organic waste treatment, and in using SCWG for hydrogen production with wet biomass.

The need for understanding the fundamentals of supercritical fluid processing and their applications to ever-widening ranges of materials and conditions continues to expand. There has been much interest in the use of supercritical fluids as solvents in bioprocessing of food and related materials. Admittedly, a few successful applications

of supercritical fluids could be cited but these are minuscule in comparison with the potential applications as yet undeveloped and unexploited. This volume is based on the papers presented at the symposium on Super critical fluid processing of biomaterials: Basics of process design and applications organized during the 8th World Congress of Food Science and Technology held in Toronto, Sept. 29-0ct. 4, 1991. The coverage represents the breadth of interest in this field around the world. I am indeed indebted to the authors who so willingly brought their work to the symposium and provided revised manuscripts of their papers for publication. I would also like to acknowledge the assistance of Professor M. LeMaguer of the University of Guelph for co-chairing the symposium. , The organization and successful completion of the symposium and the production of this volume is due to the assistance of the Technical Program Committee of the Congress and the cooperation of many people. I express my appreciation to them all. S. S. H.

Although supercritial fluid (SCF) technology is now widely used in extraction and purification processes (in the petrochemical, food and pharmaceuticals industries), this book is the first to address the new application of cleaning. The objective is to provide a roadmap for readers who want to know whether SCF technology can meet their own processing and cleaning needs. It is particularly helpful to those striving to balance the requirements for a clean product and a clean environment. The interdisciplinary subject matter will appeal to scientists and engineers in all specialties ranging from materials and polymer sciences to chemistry and physics. It is also useful to those developing new processes for other applications, and references given at the end of each chapter provide links to the wider body of SCF literature. The book is organized with topics progressing from the fundamental nature of the supercritical state, through process conditions and materials interactions, to economic considerations. Practical examples are included to show how the technology has been successfully applied. The first four chapters consider principles governing SCF processing, detailing issues such as solubility, design for cleanability, and the dynamics of particle removal. The next three chapters discuss surfactants and microemulsions, SCF interaction with polymers, and the use of supercritical carbon dioxide (CO2) as a cleaning solvent. The closing chapters focus on more practical considerations such as scaleup, equipment costs, and financial analysis.

Supercritical Fluid Technology: Theory and Application to Technology Forecasting

The technology of application of fluids in the supercritical state is a viable option and a high quality scientific method for obtaining materials, insulation, and extractions among other situations in which it may be applied yielding a high quality material. Due to its wide range of application, it has been extensively used to investigate different raw materials focusing on obtaining high quality products and applicability in various industrial segments. Its use has been mentioned in several studies as a high-quality and efficient technology for obtaining high-value added products. This book discusses the technology used in supercritical fluid extraction, as well as its applications and limitations.

Supercritical Fluid Technology in Materials Science and EngineeringSyntheses: Properties, and ApplicationsCRC Press

Very Good,No Highlights or Markup,all pages are intact.

The potential of supercritical fluid methods is presented in a comprehensive way. On the basis of a careful discussion of physical and chemical principles, the application of this method in process technology is demonstrated.

Supercritical fluids are neither gas nor liquid, but can be compressed gradually from low to high density and they are therefore interesting and important as tunable solvents and reaction media in the chemical process industry. By adjusting the density the properties of these fluids can be customised and manipulated for a given process - physical or chemical transformation. Separation and processing using supercritical solvents such as CO2 are currently on-line commercially in the food, essential oils and polymer industries. Many agencies and industries are considering the use of supercritical water for waste remediation. Supercritical fluid chromatography represents another, major analytical application. Significant advances have recently been made in materials processing, ranging from particle formation to the creation of porous materials. The chapters in this book provide tutorial accounts of topical areas centred around: (1) phase equilibria, thermodynamics and equations of state; (2) critical behaviour, crossover effects; (3) transport and interfacial properties; (4) molecular modelling, computer simulation; (5) reactions, spectroscopy; (6) phase separation kinetics; (7) extractions; (8) applications to polymers, pharmaceuticals, natural materials and chromatography; (9) process scale-up.

Interconnecting the fundamentals of supercritical fluid (SCF) technologies, their current and anticipated utility in drug delivery, and process engineering advances from related methodological domains and pharmaceutical applications, this volume unlocks the potential of supercritical fluids to further the development of improved pharmaceutical prod

Using SuperCritical Fluids (SCFs) in various processes is not new, because Mother Nature has been processing minerals in aqueous solutions at critical and supercritical pressures for billions of years. Somewhere in the 20th century, SCFs started to be used in various industries as working fluids, coolants, chemical agents, etc. Written by an international team of experts and complete with the latest research, development, and design, Advanced Supercritical Fluids Technologies is a unique technical book, completely dedicated to modern and advanced applications of supercritical fluids in various industries.Advanced Supercritical Fluids Technologies provides engineers and specialists in various industries dealing with SCFs as well as researchers, scientists, and students of the corresponding departments with a comprehensive overview of the current status, latest trends and developments of these technologies.Dr Igor Pioro is a professor at the University of Ontario Institute of Technology, Canada, and the Founding Editor of the ASME Journal of Nuclear Engineering and Radiation Science.

This fully revised edition of Handbook of Pharmaceutical Granulation Technology covers the rapid advances in the science of agglomeration, process control, process modelling, scale-up, emerging particle engineering technologies, along with current regulatory changes presented by some of the prominent scientist and subject matter experts around the globe. Learn from more than 50 global subject matter experts who share their years of experience in areas ranging from drug delivery and pharmaceutical technology to advances in nanotechnology. Every pharmaceutical scientist should own a copy of this fourth edition resource. Key Features: Theoretical discussions covering granulation and engineering perspectives. Covers new advances in expert systems, process modelling and bioavailability Chapters on emerging technologies in particle engineering Updated Current research and developments in granulation technologies

This title analyzes the chemical reactions, structures and fundamental properties of supercritical fluid systems for the production of new compounds, nanomaterials, fibers, and films. It complies contemporary research and technological advances for increased selectivity and reduced waste in chemical, industrial, pharmaceutical, and biomedical applications. Topics include fluid dynamics, catalysis, hydrothermal synthesis, surfactants, conducting polymers, crystal growth, and other aspects and applications of supercritical fluids.

Supercritical fluid (SCF) technology has become an important tool of materials processing in

the last two decades. Supercritical CO2 and H2O are extensively being used in the preparation of a great variety of nanomaterials. The greatest requirement in the application of nanomaterials is its size and morphology control, which determine the application potential of the nanoparticles, as their properties vary significantly with size. The aim of this chapter is to provide a critical review of the recent advances in the use of supercritical fluids for the preparation and control of specific physical forms of pharmaceutical substances with particular attention to those used for the preparation of drug delivery systems.

In this volume, we have collected a series of reviews that cover both experimental and theoretical work geared toward the more exact requirements of current SFE applications. While we have artificially divided the volume into experimental and theoretical sections, natural overlaps will be apparent. Many of the papers on experimental and theoretical sections, natural overlaps will be apparent. Many of the papers on experimental technique contain discussions on equation of state correlations. Indeed, a good deal of the experimental work is intimately tied to a mathematical description of fluid mixtures. The theoretical section presents reviews that cover the modern theory of critical phenomena, methods to correlate near critical experimental results and approaches to understanding the behavior of near critical fluids from microscopic theory. It is hoped that the scope of these reviews will provide the reader with the basis to further develop our understanding of the behavior of supercritical fluids.

Interconnecting the fundamentals of supercritical fluid (SCF) technologies, their current and anticipated utility in drug delivery, and process engineering advances from related methodological domains and pharmaceutical applications, this volume unlocks the potential of supercritical fluids to further the development of improved pharmaceutical products-from drug powders for respiratory delivery to drug delivery systems for controlled release.

Thermodynamics of supercritical fluids with respect to lipid-containing systems; Solubility measurement of lipid constituents in supercritical fluids; Supercritical fluid extraction of oilseeds/lipids in natural products; Supercritical fractionation of lipids; Oilseed solubility and extraction modeling; Modeling of the supercritical fluid extraction rate of oilseeds; Design and economic analysis of supercritical fluid extraction processes; Supercritical fluid extraction and fractionation of fish oils; Supercritical fluid extraction of egg lipids; Supercritical fluid extraction of Cocoa and Cocoa products; Superctitical CO2 extraction of meat products and edible animal fats for cholesterol reduction; Supercritical fluid extraction of algae; Effect of supercritical fluids on residual meals and protein functionality; Treatment of food materials with supercritical carbon dioxide; Enzymatic synthesis in supercritical fluids; Basic principles and the role of supercritical fluid chromatography in lipid analysis; Supercritical fluid chromatography for the analysis of oleochemicals; Supercritical fluid chromatography of trace components in oils and fats; Analytical supercritical fluid extraction for oil and lipid analysis.

Volume 17 in the Ion Exchange and Solvent Extraction series represents the vanguard of research on solvent extraction. It covers the principles of electrolyte extraction and other subjects of increasing interest to the field. This volume begins with pharmaceutical applications of supercritical fluid solvents, particularly supercritical carbon dioxide. It also contains chapters on liquid ion exchangers and relevant experiment protocols, SCF applications in drug formulation and pollution reduction, exploiting SCF as reaction media, applications of metal bis(dicarbollide) in analytical chemistry and radioactive waste treatment, and synergistic extraction of metal ions. Volume 17 discusses the ion exchange isothermal supersaturation technique, metal separation via pH-induced parametric pumping, modeling of ion exchange kinetics for ultrapure water, and the engineering of activated carbons and carbonaceous materials for removal of

metal ions and organic micropollutants in water. Volume 17 cover topics that include supercritical fluid applications, applications of metal bis(dicarbollide), and synergistic extraction of metal ions.

In the quest for innovative drug delivery systems attempting to meet the unmet needs in pharmaceutical space, research has taken a much more complicated path that poses a significant challenge for translation. Despite the progress made with novel materials, polyesters still remain at the helm of drug delivery technologies. This book provides a single source of reference of polyester drug delivery systems that covers a broad spectrum of materials design, manufacturing techniques, and applications.

A supercritical fluid is any substance at a temperature and pressure above its critical point. It can diffuse through solids like a gas, and dissolve materials like a liquid. Additionally, close to the critical point, small changes in pressure or temperature result in large changes in density, allowing many properties to be "tuned". Supercritical fluids are suitable as a substitute for organic solvents in a range of industrial and laboratory processes. Carbon dioxide and water are the most commonly used supercritical fluids, being used for decaffeination and power generation respectively. In general terms, supercritical fluids have properties between those of a gas and a liquid. This new and important book gathers the latest research from around the globe in this field of study with a focus on such topics as: the modification and preparation of membrane in supercritical carbon dioxide, supercritical fluid technology applied to the manufacture of prebiotic carbohydrates, the pre-treatment of herbaceous matrix in a process of supercritical fluid extraction, fundamental properties and chemical reactions of supercritical methanol and others.

Synthesis of Nanostructured Materials in Near and/or Supercritical Fluids: Methods, Fundamentals and Modeling offers a comprehensive review of the current status of research, development and insights on promising future directions, covering the synthesis of nanostructured materials using supercritical fluid-based processes. The book presents fundamental aspects such as high-pressure phase behavior of complex mixtures, thermodynamics and kinetics of adsorption from supercritical solutions, mechanisms of particle formation phenomena in supercritical fluid-based processes, and models for further development. It bridges the gap between theory and application, and is a valuable resource for scientists, researchers and students alike. Includes thermodynamic and mass transfer data necessary for industrial plant design Explains the mechanisms of reactions in a supercritical fluid environment Lists numerous industrial processes for the production of many consumer products

By encouraging a deliberate, systematic approach to supercritical fluid extraction (SFE) methods and techniques, this book enables scientists and technicians to avoid disappointing results and erroneous conclusions and develop reliable guidelines for using this versatile technology.

The fifth volume in the Advances in lipid methodology series is the first with new

editor, Richard O. Adlof, but its objectives are still those of the previous editor, William W. Christie: ‘To provide readable, up-to-date reviews of rapidly expanding areas of lipid analysis and practical examples which should be of immediate use to lipid analysts’. As in the previous volumes of Advances in lipid methodology, the editor has chosen leading international experts to write individual chapters. Volume 5 contains four chapters on specific methodologies of lipid analysis and three which describe specific applications or standardization of methods. The methodologies are different scanning calorimetry for the study of physical properties of fats and oils; silver ion chromatography; atmospheric-pressure chemical-ionization mass spectrometry (APCI-MS); and supercritical fluid chromatography (SFC). Chapters on specific applications cover the analysis of genetically modified oils and the use of fatty acid profiling in the characterization of metabolic diseases. A further chapter provides an overview of the official standard methods used for fats and oils analysis and gives extensive listings of information on standards organizations.

Supercritical fluid technology can be seen as a green and environmentally friendly alternative to conventional. Current information on these topics is spread through different publications in different peer-reviewed journals. The editors were therefore of

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synthesis, and environmental protection

SCFs are currently the subjects of intense research and commercial interest. Applications such as the RESS (rapid expansion of supercritical fluid solutions) process are part of standard industrial practice. In view of their ever-growing importance in the polymer industry there is a need to fully comprehend how supercritical fluids interrelate with polymeric materials to realise the potential that can be gained from their use. The authors review the basic principles of SCFs and their application within the polymer industry: characteristics and properties, extraction of unwanted residual products, polymerisation solvents, and polymer impregnation. Processing applications such as plasticisation, foaming and blending are also considered. There is discussion of the potential within the polymer recycling industry for use of SCFs as cleaning agents or within supercritical oxidation processes. Around 400 references with abstracts from recent global literature accompany this review, sourced from the Polymer Library, to facilitate further reading. A subject index and a company index are included.

Supercritical Fluid Extraction is a technique in which CO2 is used under extremely high pressure to separate solution (e.g., removing caffeine from coffee). Separations is basic to all process industries and supercritical fluid extraction is a specific type which is receiving a high level of attention. The book will combine basic fundamentals with industrial applications. The second edition has been expanded and updated and includes new chapters on chromatography and food processing. "...this is an excellent book which is both instructive and amusing to read. Its true value is neatly summarised in one of the closing sentences: 'We have supplied you with the guidelines and criteria which you can now apply when considering supercritical fluids for your own needs.'' - Chemistry in Britain, February 1995

Enhanced concern for the quality and safety of food products, increased preference for natural products, and stricter regulations on the residual level of solvents, all contribute to the growing use of supercritical fluid technology as a primary alternative for the extraction, fractionation, and isolation of active ingredients. As a solvent-free p

Proceedings of the NATO Advanced Research Workshop on the Application of Natural Microporous Materials for Environmental Technology, Smolenice Castle, Slovakia, 26-30 October 1998

This text provides an introduction to supercritical fluids with easy-to-use Excel spreadsheets suitable for both specialized-discipline (chemistry or chemical engineering student) and mixed-discipline (engineering/economic student) classes. Each chapter contains worked examples, tip boxes and end-of-the-chapter problems and projects. Part I covers web-based chemical information resources, applications and simplified theory presented in a way that allows students of all disciplines to delve into the properties of supercritical fluids and to design energy, extraction and materials formation systems for real-world processes that use supercritical water or supercritical carbon dioxide. Part II

takes a practical approach and addresses the thermodynamic framework, equations of state, fluid phase equilibria, heat and mass transfer, chemical equilibria and reaction kinetics of supercritical fluids. Spreadsheets are arranged as Visual Basic for Applications (VBA) functions and macros that are completely (source code) accessible for students who have interest in developing their own programs. Programming is not required to solve problems or to complete projects in the text. Property worksheets/spreadsheets that are easy to use in learning environments Worked examples with Excel VBA Worksheet functions allow users to design their own processes Fluid phase equilibria and chemical equilibria worksheets allow users to change conditions, study new solutes, co-solvents, chemical systems or reactions

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