



SUPERCritical FLUID SCIENCE AND TECHNOLOGY SERIES
EDITOR: EROGAN KIRAN

VOLUME 4

INTRODUCTION TO SUPERCritical FLUIDS

A Spreadsheet-based Approach

RICHARD SMITH, HIROSHI INOMATA
AND COR PETERS



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Introduction To Supercritical Fluids Volume 4 A Spreadsheet Based Approach Supercritical Fluid Science And Technology

**Richard Smith, Cor Peters, Hiroshi
Inomata**



Introduction To Supercritical Fluids Volume 4 A Spreadsheet Based Approach Supercritical Fluid Science And Technology:

Introduction to Supercritical Fluids Richard Smith, Cor Peters, Hiroshi Inomata, 2013-12-08 Foaming with Supercritical Fluids Ernesto Di Maio, Salvatore Iannace, Giuseppe Mensitieri, 2021-11-06

Foaming with Supercritical Fluids Volume Nine provides a comprehensive description of the use of supercritical fluids as blowing agents in polymer foaming. To this aim, the fundamental issues on which the proper design and control of this process are rooted are discussed in detail, with specific attention devoted to the theoretical and experimental aspects of sorption thermodynamics of a blowing agent within a polymer, the effect of the absorbed blowing agent on the thermal, interfacial and rheological properties of the expanding matter, and the phase separation of the gaseous phase and of the related bubble nucleation and growth phenomena. Several foaming technologies based on the use of supercritical blowing agents are then described, addressing the main issues in the light of the underlying chemical and physical phenomena. Offers strong fundamentals on polymer properties important on foaming. Outlines the use of supercritical fluids for foaming. Covers theoretical points of view including foam formation of the polymer gas solution to the setting of the final foam. Discusses the several processing technologies and applications.

Particle Formation with Supercritical Fluids Michael Turk, 2014-11-06

Particle formation with supercritical fluids is a promising alternative to conventional precipitation processes as it allows the reduction of particle size and control of morphology and particle size distribution without degradation or contamination of the product. The book comprehensively examines the current status of research and development and provides perspectives and insights on promising future directions. The introduction to high pressure and high temperature phase equilibria and nucleation phenomena provides the basic principles of the underlying physical and chemical phenomena, allowing the reader an understanding of the relationship between process conditions and particle characteristics. Bridging the gap between theory and application, the book imparts the scientific and engineering fundamentals for innovative particle formation processes. The interdisciplinary modus operandi will encourage cooperation between scientists and researchers from different but complementary disciplines. Focuses on the general principles of particle formation in supercritical fluids. Considers high pressure and high temperature phase equilibria, fluid dynamics and nucleation theory. Discusses the underlying physical and chemical phenomena needed to understand the different applications, pointing out the relationship between process conditions and product properties.

Hydrothermal and Supercritical Water Processes Gerd Brunner, 2014-04-04

Hydrothermal and Supercritical Water Processes presents an overview on the properties and applications of water at elevated temperatures and pressures. It combines fundamentals with production process aspects. Water is an extraordinary substance. At elevated temperatures and pressures, its properties change dramatically due to the modifications of the molecular structure of bulk water that varies from a stable three-dimensional network formed by hydrogen bonds at low and moderate temperatures to an assembly of separated polar water

molecules at high and supercritical temperatures With varying pressure and temperature water is turned from a solvent for ionic species to a solvent for polar and non polar substances This variability and an enhanced reactivity of water have led to many practical applications and to even more research activities related to such areas as energy transfer extraction of functional molecules unique chemical reactions biomass conversion and fuel materials processing destruction of dangerous compounds and recycling of useful ones growth of monolithic crystals and preparation of metallic nanoparticles This book provides an introduction into the wide range of activities that are possible in aqueous mixtures It is organized to facilitate understanding of the main features outlines the main applications and gives access to further information Summarizes fundamental properties of water for engineering applications Compares process and reactor designs Evaluates processes from thermodynamic economic and social impact viewpoints

High-Pressure Fluid Phase Equilibria Ulrich K Deiters, Thomas Kraska, 2023-12-01 High pressures play a more and more important role in modern technology Examples are the supercritical fluid extraction of medical drugs and dyes from biological material the handling of compressed or liquefied gases including natural gas or hydrogen the operation of modern thermal power plants or various technical processes for controlled particle formation High Pressure Fluid Phase Equilibria Second Edition enables understanding of the complicated phase behaviour that fluid or fluid mixtures liquids gases or supercritical phases can exhibit at elevated pressures The underlying thermodynamic equations are explained and robust algorithms for the computation of such equilibria including solid fluid equilibria are proposed Since the publication of the first edition of this book there have been many new developments for instance differential equation methods for the computation of phase equilibria accurate numerical differentiation high precision equations of state e g the GERG model Moreover more detail and explanation has been added on important topics that were only briefly examined in the original book to better assist the reader such as expansion processes and chemical reactions The book remains invaluable as a single resource for grasping the intricacies of fluid phase behaviour It enables readers to write or improve their own computer programs for the calculation of phase equilibria It will appeal to graduate students of chemical engineering and university research staff involved in chemical engineering of supercritical fluids or the physical chemistry of fluids the book can also serve as the basis of lectures or advanced students seminars Comprehensively presents the complex world of phase equilibria binary and ternary and the various methods for computing phase equilibria whilst carefully considering the relevant pressure and temperature ranges Introduces phase diagram classes how to recognize them and how to identify their characteristic features Presents rational nomenclature of binary fluid phase diagrams Includes problems and solutions for self testing exercises or seminars New to this Edition Presentation of the phase equilibria models is extended and expanded There are now more descriptions on more equations of state especially the PCSAFT EoS Features new chapter on nonisothermal applications and chemically reactive systems and extensive updates and additions to all existing chapters

Introduction to Supercritical Fluids Richard Smith, Hiroshi

Inomata, Cor Peters, 2013-12-08 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

Synthesis of Nanostructured Materials in Near and/or Supercritical Fluids

Can Erkey, Michael Turk, 2021-11-27 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

In situ Spectroscopic Techniques at High Pressure

Andreas Braeuer, 2015-12-07 In situ Spectroscopic Techniques at High Pressure provides a comprehensive treatment of in situ applications of spectroscopic techniques at high pressure and their working principles allowing the reader to develop a deep understanding of which measurements are accessible with each technique what their limitations are and for which application each technique is best suited Coverage is also given to the instrumental requirements for these applications with respect to the high pressure instrumentation and the spectroscopic components of the equipment The pedagogical style of the book is supplemented by the inclusion of study questions which aim to make it useful for graduate level courses Bridges the gap between supercritical fluid science technology and in situ spectroscopic techniques Provides a powerful guide to applying spectroscopic techniques as gainful sensors at high pressure Highlights the influence of a high pressure

environment and high pressure equipment on spectroscopic techniques Presents a deep understanding of which measurements are accessible with each technique what their limitations are and for which application each technique is best suited

Topical Themes in Energy and Resources Yasumitsu Tanaka, Michael Norton, Yu-You Li, 2015-01-30 This book combines issues several critical ones in the energy field low energy technologies renewable energies such as the hydrogen economy and geothermal energy Moving towards a more sustainable world requires a complete revolution in the way we manage energy and resources However from an academic perspective this theme is so broad that most educators and researchers tend to focus on just one aspect and maintaining the broad viewpoint which is necessary for making strategic judgments becomes difficult Tohoku University addressed this challenge when developing a new education and training program for environmental leaders and brought together the extensive range of expertise available in specific fields into one special course which forms the basis of this book Now in one volume both students and educators can be brought up to date on a wide range of critical issues currently being addressed in the field of energy and resources Chapters on resources include availability for instance rare earth metals extraction and recycling of metals and plastics and technological solutions to specific waste disposal problems In addition broader strategic issues such as limits to growth and the interaction between the economic system and environmental issues are addressed Even though each chapter provides topical data and knowledge from disparate and specialized fields the book is written at a level that is readily understandable by students from all scientific engineering and humanities fields

Innovative Food Processing Technologies ,2020-08-18 Food process engineering a branch of both food science and chemical engineering has evolved over the years since its inception and still is a rapidly changing discipline While traditionally the main objective of food process engineering was preservation and stabilization the focus today has shifted to enhance health aspects flavour and taste nutrition sustainable production food security and also to ensure more diversity for the increasing demand of consumers The food industry is becoming increasingly competitive and dynamic and strives to develop high quality freshly prepared food products To achieve this objective food manufacturers are today presented with a growing array of new technologies that have the potential to improve or replace conventional processing technologies to deliver higher quality and better consumer targeted food products which meet many if not all of the demands of the modern consumer These new or innovative technologies are in various stages of development including some still at the R D stage and others that have been commercialised as alternatives to conventional processing technologies Food process engineering comprises a series of unit operations traditionally applied in the food industry One major component of these operations relates to the application of heat directly or indirectly to provide foods free from pathogenic microorganisms but also to enhance or intensify other processes such as extraction separation or modification of components The last three decades have also witnessed the advent and adaptation of several operations processes and techniques aimed at producing high quality foods with minimum alteration of sensory and nutritive

properties Some of these innovative technologies have significantly reduced the thermal component in food processing offering alternative nonthermal methods Food Processing Technologies A Comprehensive Review Three Volume Set covers the latest advances in innovative and nonthermal processing such as high pressure pulsed electric fields radiofrequency high intensity pulsed light ultrasound irradiation and new hurdle technology Each section will have an introductory article covering the basic principles and applications of each technology and in depth articles covering the currently available equipment and or the current state of development food quality and safety application to various sectors food laws and regulations consumer acceptance advancements and future scope It will also contain case studies and examples to illustrate state of the art applications Each section will serve as an excellent reference to food industry professionals involved in the processing of a wide range of food categories e g meat seafood beverage dairy eggs fruits and vegetable products spices herbs among others

Introduction to Supercritical Fluids Richard L. Smith, Hiroshi Inomata, Cor J. Peters, 2025-10-01

Introduction to Supercritical Fluids A Spreadsheet Based Approach Second Edition provides an accessible overview of elementary supercritical fluid processes including extraction particle formation heat exchangers phase equilibrium chemical reaction equilibrium supported by 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 P Part II takes a practical approach and addresses the thermodynamic framework equations of state fluid phase equilibria heat and mass transfer newly added chemical equilibria and also reaction kinetics newly added 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 *Introduction to Supercritical Fluids Second Edition* is written primarily for graduate students and researchers in chemistry chemical engineering and materials science Provides an overview of elementary supercritical fluid processes extraction particle formation heat exchangers phase equilibrium chemical reaction equilibrium Each chapter contains practical activities with worked examples tip boxes and end of the chapter problems and projects for the reader Contains new and updated worked examples suitable for both introductory and advanced level students and fully updated Excel VBA Worksheet functions that can be used as is to perform hands on calculations simulations and analyses of supercritical fluid processes and allow users to design their own processes Includes helpful teaching aids that will simplify instruction of both introductory level students and advanced students about the merits and applications of supercritical fluids Fluid phase equilibria and chemical equilibria worksheets allow users to

change conditions study new solutes co solvents chemical systems or reactions New to this edition New chapters on mass transfer reaction kinetics and advanced topics with all previous chapters being fully updated **Introduction to Supercritical Fluids** Richard Smith,Cor Peters,Hiroshi Inomata,2013-12-08 **Physical Review** ,1995-10 Publishes papers that report results of research in statistical physics plasmas fluids and related interdisciplinary topics There are sections on 1 methods of statistical physics 2 classical fluids 3 liquid crystals 4 diffusion limited aggregation and dendritic growth 5 biological physics 6 plasma physics 7 physics of beams 8 classical physics including nonlinear media and 9 computational physics *Whitaker's Book List* ,1991 *Introduction to Supercritical Fluids* Richard Smith,Cor Peters,Hiroshi Inomata,2013-12-08 **Introduction to Supercritical Fluids** Richard Smith,Cor Peters,Hiroshi Inomata,2013-12-08 Introduction to Supercritical Fluids Richard Smith,Cor Peters,Hiroshi Inomata,2013-12-08 *Supercritical Fluid Science and Technology* Keith P. Johnston,Johannes M. L. Penninger,1989 Introduction to Supercritical Fluids Richard Smith,Cor Peters,Hiroshi Inomata,2013-12-08 **Introduction to Supercritical Fluids** Richard Smith,Cor Peters,Hiroshi Inomata,2013-12-08

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