Diffusion Mass Transfer In Fluid Systems Solution Manual

Biofiltration for Air Pollution ControlClimate Change and Terrestrial Ecosystem ModelingMass Transfer ProcessesEnvironmental Transport PhenomenaNumerical Heat Transfer and Fluid FlowFluid Mechanics, Heat Transfer, and Mass TransferUnified Analysis and Solutions of Heat and Mass DiffusionBioreaction Engineering PrinciplesDiffusion in Natural Porous MediaBasic Transport Phenomena in Materials EngineeringGas Transfer at Water SurfacesBiological and Bioenvironmental Heat and Mass TransferSeparation Process Principles with Applications Using Process Simulators, 4th EditionBasic Equations of the Mass Transport Through a Membrane LayerMulticomponent DiffusionIntroduction to Chemical Engineering Fluid MechanicsAn Introduction to Transport Phenomena In Materials Engineering, 2nd editionMass TransferMicro Total Analysis Systems '98Diffusional Mass TransferHeat and Mass TransferMass Transport in Solids and FluidsDiffusion and Mass TransferTransport Processes in Porous MediaMass Transport PhenomenaNumerical Simulation of Fluid Flow and Heat/Mass Transfer ProcessesHeat and Mass TransferTransport phenomenaTransport Phenomena in Micro Process EngineeringMulticomponent Mass TransferMass TransferDiffusionDiffusionMass and Heat TransferHeat & Mass Transfer 2ETransfer Phenomena in Fluid and Heat Flows VIISupercritical FluidsMass Transport in Solids

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Biofiltration for Air Pollution Control

Computational fluid flow is not an easy subject. Not only is the mathematical representation of physico-chemical hydrodynamics complex, but the accurate numerical solution of the resulting equations has challenged many numerate scientists and engineers over the past two decades. The modelling of physical phenomena and testing of new numerical schemes has been aided in the last 10 years or so by a number of basic fluid flow programs (MAC, TEACH, 2-E-FIX, GENMIX, etc). However, in 1981 a program (perhaps more precisely, a software product) called PHOENICS was released that was then (and still remains) arguably, the most powerful computational tool in the whole area of endeavour surrounding fluid dynamics. The aim of PHOENICS is to provide a framework for the modelling of complex processes involving fluid flow, heat transfer and chemical reactions. PHOENICS has now been is use for four years by a wide range of users across the world. It was thus perceived as useful to provide a forum for PHOENICS users to share their experiences in trying to address a wide range of problems. So it was that the First International PHOENICS Users Conference was conceived and planned for September 1985. The location, at the Dartford Campus of Thames Polytechnic, in the event, proved to be an ideal site, encouraging substantial

interaction between the participants.

Climate Change and Terrestrial Ecosystem Modeling

Provides an essential introduction to modeling terrestrial ecosystems in Earth system models for graduate students and researchers.

Mass Transfer Processes

Written with the third-year engineering students of undergraduate level in mind, this well set out textbook explains the fundamentals of Heat and Mass Transfer. Written in question-answer form, the book is precise and easy to understand. The book presents an exhaustive coverage of the theory, definitions, formulae and expenses which are well supported by plenty of diagrams and problems in order to make the underlying principles more comprehensive.

Environmental Transport Phenomena

This text allows instructors to teach a course on heat and mass transfer that will equip students with the pragmatic, applied skills required by the modern chemical industry. This new approach is a combined presentation of heat and mass transfer,

maintaining mathematical rigor while keeping mathematical analysis to a minimum. This allows students to develop a strong conceptual understanding, and teaches them how to become proficient in engineering analysis of mass contactors and heat exchangers and the transport theory used as a basis for determining how critical coefficients depend upon physical properties and fluid motions. Students will first study the engineering analysis and design of equipment important in experiments and for the processing of material at the commercial scale. The second part of the book presents the fundamentals of transport phenomena relevant to these applications. A complete teaching package includes a comprehensive instructor's guide, exercises, case studies, and project assignments.

Numerical Heat Transfer and Fluid Flow

This excellent monograph by two experts presents a generalized and systematic approach to the analytic solution of seven different classes of linear heat and mass diffusion problems. 1984 edition.

Fluid Mechanics, Heat Transfer, and Mass Transfer

Separation Process Principles with Applications Using Process Simulator, 4th

Edition is the most comprehensive and up-to-date treatment of the major separation operations in the chemical industry. The 4th edition focuses on using process simulators to design separation processes and prepares readers for professional practice. Completely rewritten to enhance clarity, this fourth edition provides engineers with a strong understanding of the field. With the help of an additional co-author, the text presents new information on bioseparations throughout the chapters. A new chapter on mechanical separations covers settling, filtration and centrifugation including mechanical separations in biotechnology and cell lysis. Boxes help highlight fundamental equations. Numerous new examples and exercises are integrated throughout as well.

Unified Analysis and Solutions of Heat and Mass Diffusion

This broad-based book covers the three major areas of Chemical Engineering. Most of the books in the market involve one of the individual areas, namely, Fluid Mechanics, Heat Transfer or Mass Transfer, rather than all the three. This book presents this material in a single source. This avoids the user having to refer to a number of books to obtain information. Most published books covering all the three areas in a single source emphasize theory rather than practical issues. This book is written with emphasis on practice with brief theoretical concepts in the form of questions and answers, not adopting stereo-typed question-answer approach practiced in certain books in the market, bridging the two areas of theory and

practice with respect to the core areas of chemical engineering. Most parts of the book are easily understandable by those who are not experts in the field. Fluid Mechanics chapters include basics on non-Newtonian systems which, for instance find importance in polymer and food processing, flow through piping, flow measurement, pumps, mixing technology and fluidization and two phase flow. For example it covers types of pumps and valves, membranes and areas of their use, different equipment commonly used in chemical industry and their merits and drawbacks. Heat Transfer chapters cover the basics involved in conduction, convection and radiation, with emphasis on insulation, heat exchangers, evaporators, condensers, reboilers and fired heaters. Design methods, performance, operational issues and maintenance problems are highlighted. Topics such as heat pipes, heat pumps, heat tracing, steam traps, refrigeration, cooling of electronic devices, NOx control find place in the book. Mass transfer chapters cover basics such as diffusion, theories, analogies, mass transfer coefficients and mass transfer with chemical reaction, equipment such as tray and packed columns, column internals including structural packings, design, operational and installation issues, drums and separators are discussed in good detail. Absorption, distillation, extraction and leaching with applications and design methods, including emerging practices involving Divided Wall and Petluk column arrangements, multicomponent separations, supercritical solvent extraction find place in the book.

Bioreaction Engineering Principles

This 2000 textbook covers mass transport in solids and fluids, for materials science and engineering students.

Diffusion in Natural Porous Media

Providing a foundation in heat and mass transport, this book covers engineering principles of heat and mass transfer. The author discusses biological content, context, and parameter regimes and supplies practical applications for biological and biomedical engineering, industrial food processing, environmental control, and waste management. The book contains end-of-chapter problems and sections highlighting key concepts and important terminology It offers cross-references for easy access to related areas and relevant formulas, as well as detailed examples of transport phenomena, and descriptions of physical processes. It covers mechanisms of diffusion, capillarity, convection, and dispersion.

Basic Transport Phenomena in Materials Engineering

In this book, the fundamentals of chemical engineering are presented with respect to applications in micro system technology, microfluidics, and transport processes within microstructures. Special features of the book include the state-of-the-art in micro process engineering, a detailed treatment of transport phenomena for

engineers, and a design methodology from transport effects to economic considerations.

Gas Transfer at Water Surfaces

The transfer across the surface of environmental waters is of interest as an important phase in the geophysical and natural biochemical cycles of numer ous substances; indeed it governs the transition, one way or the other, be tween the dissolved state in the water and the gaseous state in the atmo sphere. Especially with increasing population and industrialization, gas transfer at water surfaces has become a critical factor in the understanding of the various pathways of wastes in the environment and of their engineering management. This interfacial mass transfer is, by its very nature, highly complex. The air and the water are usually in turbulent motion, and the interface be tween them is irregular, and disturbed by waves, sometimes accompanied by breaking, spray and bubble formation. Thus the transfer involves a wide variety of physical phenomena occurring over a wide range of scales. As a consequence, scientists and engineers from diverse disciplines and problem areas, have approached the problem, often with greatly differing analytical and experimental techniques and methodologies.

Biological and Bioenvironmental Heat and Mass Transfer

Separation Process Principles with Applications Using Process Simulators, 4th Edition

Revised extensively ad updated with several new topics, this book discusses the principles and applications of "Heat and Mass Tansfer". It is written with extensive pedagogy, clear explanations adn examples throughout to elucidate the concepts and facilitate problem solving.

Basic Equations of the Mass Transport Through a Membrane Layer

The subject of this book is to study the porous media and the transport processes occur there. As a first step, the authors discuss several techniques for artificial representation of porous. Afterwards, they describe the single and multi phase flows in simplistic and complex porous structures in terms of macroscopic and microscopic equations as well as of their analytical and numerical solutions. Furthermore, macroscopic quantities such as permeability are introduced and reviewed. The book also discusses with mass transport processes in the porous media which are further strengthen by experimental validation and specific technological applications. This book makes use of state-of-the-art techniques for

the modeling of transport processes in porous structures, and considers of realistic sorption mechanisms. It the applies advanced mathematical techniques for upscaling of the major quantities, and presents the experimental investigation and application, namely, experimental methods for the measurement of relevant transport properties. The main benefit of the book is that it discusses all the topics related to transport in porous media (including state-of-the-art applications) and presents some of the most important theoretical, numerical and experimental developments in porous media domain, providing a self-contained major reference that is appealing to both the scientists and the engineers. At the same time, these topics encounter a variety of scientific and engineering disciplines, such as chemical, civil, agricultural, mechanical engineering. The book is divided in several chapters that intend to be a resume of the current state of knowledge for benefit of related professionals and scientists.

Multicomponent Diffusion

Introduction to Chemical Engineering Fluid Mechanics

This 2000 textbook covers mass transport in solids and fluids, for materials science and engineering students.

An Introduction to Transport Phenomena In Materials Engineering, 2nd edition

With a detailed analysis of the mass transport through membrane layers and its effect on different separation processes, this book provides a comprehensive look at the theoretical and practical aspects of membrane transport properties and functions. Basic equations for every membrane are provided to predict the mass transfer rate, the concentration distribution, the convective velocity, the separation efficiency, and the effect of chemical or biochemical reaction taking into account the heterogeneity of the membrane layer to help better understand the mechanisms of the separation processes. The reader will be able to describe membrane separation processes and the membrane reactors as well as choose the most suitable membrane structure for separation and for membrane reactor. Containing detailed discussion of the latest results in transport processes and separation processes, this book is essential for chemistry students and practitioners of chemical engineering and process engineering. Detailed survey of the theoretical and practical aspects of every membrane process with specific equations Practical examples discussed in detail with clear steps Will assist in planning and preparation of more efficient membrane structure separation

Mass Transfer

Designed for introductory undergraduate courses in fluid mechanics for chemical engineers, this stand-alone textbook illustrates the fundamental concepts and analytical strategies in a rigorous and systematic, yet mathematically accessible manner. Using both traditional and novel applications, it examines key topics such as viscous stresses, surface tension, and the microscopic analysis of incompressible flows which enables students to understand what is important physically in a novel situation and how to use such insights in modeling. The many modern worked examples and end-of-chapter problems provide calculation practice, build confidence in analyzing physical systems, and help develop engineering judgment. The book also features a self-contained summary of the mathematics needed to understand vectors and tensors, and explains solution methods for partial differential equations. Including a full solutions manual for instructors available at www.cambridge.org/deen, this balanced textbook is the ideal resource for a one-semester course.

Micro Total Analysis Systems '98

Clear and complete description of diffusion in fluids, for undergraduate students in chemical engineering.

Diffusional Mass Transfer

Multicomponent Diffusion discusses the multicomponent diffusion of the three phases of matter. The book is comprised of nine chapters that cover studies of multicomponent diffusion and mass transfer with an emphasis on the chemical characteristics responsible for multicomponent diffusion. Chapter 1 provides an introductory discourse about multicomponent diffusion. Chapter 2 discusses binary diffusion, while Chapter 3 covers multicomponent flux equation. The measurement of ternary diffusion and the estimation of ternary diffusion coefficients are also explained in the book. A chapter then covers the interacting systems, and the subsequent chapter talks about membranes without mobile carriers. The text also discusses carrier-containing membranes and the multicomponent mass transfer. The book will be of great use to researchers and professionals whose work requires a good understanding of multicomponent diffusion.

Heat and Mass Transfer

This book focuses on heat and mass transfer, fluid flow, chemical reaction, and other related processes that occur in engineering equipment, the natural environment, and living organisms. Using simple algebra and elementary calculus, the author develops numerical methods for predicting these processes mainly based on physical considerations. Through this approach, readers will develop a deeper understanding of the underlying physical aspects of heat transfer and fluid flow as well as improve their ability to analyze and interpret computed results.

Mass Transport in Solids and Fluids

This volume of the journal ⬚Defect and Diffusion Forum⬚ presents to readers the special issue ⬚Transfer Phenomena in Fluid and Heat Flows VII⬚ which contains articles covering theoretical and practical aspects of modeling and numerical investigation of the diffusion processes, heat and mass transfer processes and fluid mechanics in different media and engineering objects.

Diffusion and Mass Transfer

This is the second edition of the text "Bioreaction Engineering Principles" by Jens Nielsen and John Villadsen, originally published in 1994 by Plenum Press (now part of Kluwer). Time runs fast in Biotechnology, and when Kluwer Plenum stopped reprinting the first edition and asked us to make a second, revised edition we happily accepted. A text on bioreactions written in the early 1990's will not reflect the enormous development of experimental as well as theoretical aspects of cellular reactions during the past decade. In the preface to the first edition we admitted to be newcomers in the field. One of us (JV) has had 10 more years of job training in biotechnology, and the younger author (IN) has now received international recognition for his work with the hottest topics of "modem" biotechnology. Furthermore we are happy to have induced Gunnar Liden, professor

of chemical reaction engineering at our sister university in Lund, Sweden to join us as co-author of the second edition. His contribution, especially on the chemical engineering aspects of "real" bioreactors has been of the greatest value. Chapter 8 of the present edition is largely unchanged from the first edition. We wish to thank professor Martin Hjortso from LSU for his substantial help with this chapter.

Transport Processes in Porous Media

This book provides a solid foundation in the principles of heat and mass transfer and shows how to solve problems by applying modern methods. The basic theory is developed systematically, exploring in detail the solution methods to all important problems. The revised second edition incorporates state-of-the-art findings on heat and mass transfer correlations. The book will be useful not only to upper- and graduate-level students, but also to practicing scientists and engineers. Many worked-out examples and numerous exercises with their solutions will facilitate learning and understanding, and an appendix includes data on key properties of important substances.

Mass Transport Phenomena

The All-in-One Guide to Mass Transport Phenomena: From Theory to Examples and

Computation Mass transfer processes exist in practically all engineering fields and many biological systems; understanding them is essential for all chemical engineering students, and for practitioners in a broad range of practices, such as biomedical engineering, environmental engineering, material engineering, and the like. Mass Transfer Processes combines a modern, accessible introduction to modeling and computing these processes with demonstrations of their application in designing reactors and separation systems. P. A. Ramachandran's integrated approach balances all the knowledge readers need to be effective, rather than merely paying lip service to some crucial topics. He covers both analytical and numerical solutions to mass transfer problems, demonstrating numerical problem-solving with widely used software packages, including MATLAB and CHEBFUN. Throughout, he links theory to realistic examples, both traditional and contemporary. Theory, examples, and in-depth coverage of differential, macroscopic, and mesoscopic modeling Physical chemistry aspects of diffusion phenomena Film models for calculating local mass transfer rates and diffusional interaction in gas–solid and gas–liquid reaction systems Application of mass transfer models in rate-based separation processes, and systems with simultaneous heat and mass transfer Convective mass transfer: empirical correlation, internal and external laminar flows, and turbulent flows Heterogeneous systems, from laminar flow reactors, diffusion-reaction models, reactive membranes, and electrochemical reactors Computations of mass transfer effects in multicomponent systems Solid–gas noncatalytic reactions for chemical,

metallurgical, environmental, and electronic processes Applications in electrochemical and biomedical systems Design calculations for humidification, drying, and condensation systems and membrane-based separations Analysis of adsorption, chromatography, electrodialysis, and electrophoresis

Numerical Simulation of Fluid Flow and Heat/Mass Transfer Processes

This classic text on fluid flow, heat transfer, and mass transport has been brought up to date in this second edition. The author has added a chapter on "Boiling and Condensation" that expands and rounds out the book's comprehensive coverage on transport phenomena. These new topics are particularly important to current research in renewable energy resources involving technologies such as windmills and solar panels. The book provides you and other materials science and engineering students and professionals with a clear yet thorough introduction to these important concepts. It balances the explanation of the fundamentals governing fluid flow and the transport of heat and mass with common applications of these fundamentals to specific systems existing in materials engineering. You will benefit from: • The use of familiar examples such as air and water to introduce the influences of properties and geometry on fluid flow. • An organization with sections dealing separately with fluid flow, heat transfer, and mass transport. This

sequential structure allows the development of heat transport concepts to employ analogies of heat flow with fluid flow and the development of mass transport concepts to employ analogies with heat transport. • Ample high-quality graphs and figures throughout. • Key points presented in chapter summaries. • End of chapter exercises and solutions to selected problems. • An all new and improved comprehensive index.

Heat and Mass Transfer

Transport phenomena

Transport Phenomena in Micro Process Engineering

The number-one environmental threat to public health, air pollution remains a pressing problem-made even more complicated by the massive quantity and diversity of air pollution sources. Biofiltration technology (using micro-organisms growing on porous media) is being recognized as one of the most advantageous means to convert pollutants to harmless products. Done properly, biofiltration works at a reasonable cost-utilizing inexpensive components, without requiring fuel

or generating hazardous by-products. Firmly established in Europe, biofiltration techniques are being increasingly applied in North America: Biofiltration for Air Pollution Control offers the necessary knowledge to "do it right."

Multicomponent Mass Transfer

A proper understanding of diffusion and mass transfer theory is critical for obtaining correct solutions to many transport problems. Diffusion and Mass Transfer presents a comprehensive summary of the theoretical aspects of diffusion and mass transfer and applies that theory to obtain detailed solutions for a large number of important problems. Particular attention is paid to various aspects of polymer behavior, including polymer diffusion, sorption in polymers, and volumetric behavior of polymer–solvent systems. The book first covers the five elements necessary to formulate and solve mass transfer problems, that is, conservation laws and field equations, boundary conditions, constitutive equations, parameters in constitutive equations, and mathematical methods that can be used to solve the partial differential equations commonly encountered in mass transfer problems. Jump balances, Green's function solution methods, and the free-volume theory for the prediction of self-diffusion coefficients for polymer–solvent systems are among the topics covered. The authors then use those elements to analyze a wide variety of mass transfer problems, including bubble dissolution, polymer sorption and desorption, dispersion, impurity migration in plastic containers, and

utilization of polymers in drug delivery. The text offers detailed solutions, along with some theoretical aspects, for numerous processes including viscoelastic diffusion, moving boundary problems, diffusion and reaction, membrane transport, wave behavior, sedimentation, drying of polymer films, and chromatography. Presenting diffusion and mass transfer from both engineering and fundamental science perspectives, this book can be used as a text for a graduate-level course as well as a reference text for research in diffusion and mass transfer. The book includes mass transfer effects in polymers, which are very important in many industrial processes. The attention given to the proper setup of numerous problems along with the explanations and use of mathematical solution methods will help readers in properly analyzing mass transfer problems.

Mass Transfer

Addresses the use of rigorous multicomponent mass transfer models for the simulation and design of process equipment. Deals with the basic equations of diffusion in multicomponent systems. Describes various models and estimations of rates of mass and energy transfer. Covers applications of multicomponent mass transfer models to process design. Includes appendices providing necessary mathematical background. Contains a large number of numerical examples worked out in detail.

Diffusion

Micro-TAS '98 is the third of a series of symposia initiated by MBSA (University of Twente) in 1994, on the subject of miniaturizing, and integrating within a monolithic structure, the chemical, biochemical and biological procedures commonly used for analysis and synthesis. The primary tool used to develop micro-total analysis systems (mu- TAS) has been micro-photolithographic patterning and micromachining. These powerful tools of Micro System Technology (MST or MEMS) have been applied in highly imaginative ways to develop microchip chemical arrays, fully integrated pump and fluid manifolds, and electrokinetically driven micro-channel systems to be used for genetic analysis, clinical diagnostics and environmental monitoring, and to integrate reactions as diverse as the polymerase chain reaction (PCR) and the large volume, partial oxidation of ammonia. This text illustrates the rapid expansion of the field, the extensive industrial involvement, the increasing number of participating researchers, the expanding range of concepts and applications that utilize MST and microfluidic devices, and new MST-compatible plastic micro-machining to meet the needs of the life science community. This volume contains the proceedings of the Third International Symposium on Micro-Total Analysis Systems, mu-TAS '98, held on October 13-16 in Banff, Alberta, Canada. State-of-the-art invited and contributed papers presented by the world's leading mu- TAS research groups provide a highly informative picture of the growth since 1994 and of the promising future of this exciting and

rapidly growing field.

Diffusion

A thorough introduction to the fundamentals and applications of microscopic and macroscopic mass transfer.

Mass and Heat Transfer

Diffusion in Natural Porous Media: Contaminant Transport, Sorption/Desorption and Dissolution Kinetics introduces the general principles of diffusion in the subsurface environment and discusses the implications for the fate and transport of contaminants in soils and groundwater. Emphasis is placed on sorption/desorption and the dissolution kinetics of organic contaminants, both of which are limited by the slow speed of molecular diffusion. Diffusion in Natural Porous Media: Contaminant Transport, Sorption/Desorption and Dissolution Kinetics compiles methods for calculating the diffusion coefficients of organic compounds (in aqueous solution or vapor phase) in natural porous media. The author uses analytical solutions of Fick's 2nd law and some simple numerical models to model diffusive transport under various initial and boundary conditions. A number of these models may be solved using spreadsheets. The book examines

sorption/desorption rates of organic compounds in various soils and aquifer materials, and also examines the dissolution kinetics of nonaqueous phase liquids in aquifers, in both the trapped residual phase and in pools. Diffusion in Natural Porous Media: Contaminant Transport, Sorption/Desorption and Dissolution Kinetics concludes with a discussion of the impact of slow diffusion processes on soil and groundwater decontamination and the implications of these processes for groundwater risk assessment.

Heat & Mass Transfer 2E

Environmental Transport Phenomena offers a detailed yet accessible introduction to transport phenomena. It begins by explaining the underlying principles and mechanisms that govern mass transport and continues by tackling practical problems spanning all subdisciplines of environmental science and chemical engineering. Assuming some knowledge of ordinary differential equations and a familiarity with basic applications of fluid mechanics, this classroom-tested text: Addresses mass conservation and macroscopic mass balances, placing a special emphasis on applications to environmental processes Covers the fundamentals of diffusive transport, applications of the diffusion equation, and diffusive transport in reactive systems Discusses convective transport, hydrodynamic dispersion, and transport in multiphase systems Presents a mathematical framework for formulating and solving transport phenomena problems Environmental Transport

Phenomena makes an ideal textbook for a one-semester advanced undergraduate or graduate introductory course in transport phenomena. It provides a fundamental understanding of how to quantify the spread and distribution of contaminants in the environment as well as the basis for designing processes related to water purification, wastewater treatment, and solid waste disposal, among others.

Transfer Phenomena in Fluid and Heat Flows VII

This book covers a wide variety of topics related to advancements in different stages of mass transfer modelling processes. Its purpose is to create a platform for the exchange of recent observations, experiences, and achievements. It is recommended for those in the chemical, biotechnological, pharmaceutical, and nanotechnology industries as well as for students of natural sciences, technical, environmental and employees in companies which manufacture machines for the above-mentioned industries. This work can also be a useful source for researchers and engineers dealing with mass transfer and related issues.

Supercritical Fluids

This book presents balanced treatment of transport phenomena and equal emphasis on mass transport, momentum transport and energy transport. It include

extensive reference to applications of material covered and the addition of appendices on applied mathematics topics, the Boltzmann equation, and a summary of the basic equations in several coordinate systems. 'Transport phenomena' offers literature citations throughout so you and your students know where to find additional material. It contains - Transport properties in two-phase systems; Boundary-layer theory; Heat and mass transfer coefficients; Dimensional analysis and scaling.

Mass Transport in Solids and Fluids

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

Mass Transfer in Multicomponent Mixtures

The clearest coverage available of diffusion and mass transfer, which is a key part of the chemical engineering curriculum.

Transport Phenomena

This book presents the basic theory and experimental techniques of transport phenomena in materials processing operations. Such fundamental knowledge is highly useful for researchers and engineers in the field to improve the efficiency of conventional processes or develop novel technology. Divided into four parts, the book comprises 11 chapters describing the principles of momentum transfer, heat transfer, and mass transfer in single phase and multiphase systems. Each chapter includes examples with solutions and exercises to facilitate students' learning. Diagnostic problems are also provided at the end of each part to assess students' comprehension of the material. The book is aimed primarily at students in materials science and engineering. However, it can also serve as a useful reference text in chemical engineering as well as an introductory transport phenomena text in mechanical engineering. In addition, researchers and engineers engaged in materials processing operations will find the material useful for the design of experiments and mathematical models in transport phenomena. This volume contains unique features not usually found in traditional transport phenomena texts. It integrates experimental techniques and theory, both of which are required to adequately solve the inherently complex problems in materials processing operations. It takes a holistic approach by considering both single and multiphase systems, augmented with specific practical examples. There is a discussion of flow and heat transfer in microscale systems, which is relevant to the design of modern processes such as fuel cells and compact heat exchangers. Also described are auxiliary relationships including turbulence modeling, interfacial phenomena,

rheology, and particulate systems, which are critical to many materials processing operations.

ROMANCE ACTION & ADVENTURE MYSTERY & THRILLER BIOGRAPHIES & HISTORY CHILDREN'S YOUNG ADULT FANTASY HISTORICAL FICTION HORROR LITERARY FICTION NON-FICTION SCIENCE FICTION