The Soret Effect A Review Of Recent Experimental Results

Most processes in geology are a consequence at some level of the flow of energy or mass. Heat conduction and chemical diffusion are examples of two of these sorts of flows which are driven by temperature and chemical potential imbalances, respectively. In the general case these flows may be coupled so that, for instance, a temperature gradient may result in a flow of mass as well as heat. This effect in liquids was demonstrated by Soret (1879) and bears his name. In gases or solids the phenomenon is given the general name thermal diffusion. It was the purpose of this research program to examine the Soret effect in molten silicates under laboratory conditions. Results of these experiments are used to evaluate the form and quantitative values of many thermodynamic and kinetic properties of silicate melts over a range of temperature, pressure, and bulk composition. The author published a comprehensive review and synthesis with a microscopic theoretical explanation for the effect at low pressure in silicate liquids of geological interest. He conducted experimental investigations of molecular diffusion in the absence of a thermal gradient through experiments involving dissolution of solid silicates in molten silicate and interdiffusion of species between miscible silicate liquids. Collectively these results enable the author to construct a more comprehensive model of molecular diffusion in magmatic liquids. He has applied this model to problems of magma mixing and crustal assimilation.

Biomechanics applies the laws and techniques of mechanics in the study of biological systems and related phenomena. Biomechanics uses mathematical and computational tools such as model construction of musclo-skeletal system, body fluid circulation, to aid medical diagnosis, therapeutics and surgery planning, designing of prostheses and implants or in tissue engineering. Present book targets specific topics pertaining to the biomechanics of soft tissues. Subjects addressed includes solids and multi-species mixtures as open systems: a continuum mechanics perspective; electro-chemo-mechanical couplings: tissues with a fixed electric charge and growth of biological tissues.

This book presents the physical science experiments in a space microgravity environment conducted on board the SJ-10 recoverable satellite, which was launched on April 6th, 2016 and recovered on April 18th, 2016. The experiments described were selected from ~100 proposals from various institutions in China and around the world, and have never previously been conducted in the respective fields. They involve fluid physics and materials science, and primarily investigate the kinetic properties of matter in a space microgravity environment. The book provides a comprehensive review of these experiments, as well as the mission’s execution, data collection, and scientific outcomes.

Fuel cells are expected to play a significant role in the next generation of energy systems and road vehicles for transportation. However, substantial progress is required in reducing manufacturing costs and improving performance. This book

aims to contribute to the understanding of the transport processes in solid oxide fuel cells (SOFC), proton exchange membrane fuel cells (PEMFC) and direct methanol fuel cells (DMFC), which are of current interest. A wide range of topics is covered, featuring contributions from prominent scientists and engineers in the field. A detailed summary of state-of-the-art knowledge and future needs, this text will be of value to graduate students and researchers working on the development of fuel cells within academia and industry.

This book provides a sound basis in the challenging area of the mechanics of unsaturated geomaterials. The objective is to supply the reader with an exhaustive overview starting from the basics and covering the most recent theories and applications (i.e. natural disasters, nuclear waste disposal, oil and agriculture productions). The presentation of the fundamental concepts is based on an interdisciplinary approach, in the areas of soil, rock and cement-based material mechanics.

Over the last three decades, advances in modeling flow, heat, and mass transfer through a porous medium have dramatically transformed engineering applications. Comprehensive and cohesive, Handbook of Porous Media, Second Edition presents a compilation of research related to heat and mass transfer including the development of practical applications

Thermodiffusion describes the coupling between a temperature gradient and a resulting mass flux. Traditionally, the focus has been on simple fluids, and it is now extending to more complex systems such as electrolytes, polymers, colloidal dispersions and magnetic fluids. This book widens the scope even further by including applications in ionic solids. Written as a set of tutorial reviews, it will be useful to experts, nonspecialist researchers and postgraduate students alike.

This book focuses on droplets and sprays relevant to combustion and propulsion applications. The book includes fundamental studies on the heating, evaporation and combustion of individual droplets and basic mechanisms of spray formation. The contents also extend to the latest analytical, numerical and experimental techniques for investigating the behavior of sprays in devices like combustion engines and gas turbines. In addition, the book explores several emerging areas like interactions between sprays and flames and the dynamic characteristics of spray combustion systems on the fundamental side, as well as the development of novel fuel injectors for specific devices on the application side. Given its breadth of coverage, the book will benefit researchers and professionals alike.

Front Matter -- Thermal Structure of Deep Earth. Melting of Fe Alloys and the Thermal Structure of the Core / Rebecca A Fischer -- Temperature of the Lower Mantle and Core Based on Ab Initio Mineral Physics Data / Taku Tsuchiya, Kenji Kawai, Xianlong Wang, Hiroki Ichikawa, Haruhiko Dekura -- Heat Transfer in the Core and Mantle / Abby Kavner, Emma S G Rainey -- Thermal State and Evolution of the Earth Core and Deep Mantle / Labrosse Stéphane -- Structures, Anisotropy, and Plasticity of Deep Earth Materials. Crystal Structures of Core Materials / Razvan Caracas -- Crystal Structures of Minerals in the Lower Mantle / June K Wicks, Thomas S Duffy -- Deformation of Core and Lower Mantle Materials / Sébastien Merkel, Patrick Cordier -- Using Mineral Analogs to Understand the Deep Earth / Simon A T Redfern -- Physical Properties of Deep Interior. Ground Truth / George Helffrich -- Physical Properties of the Inner Core / Daniele Antonangeli -- Physical Properties of the Outer Core / Hidenori Terasaki -- Chemistry and Phase Relations of Deep Interior. The Composition of the Lower Mantle and Core / William F McDonough -- Metal-Silicate Partitioning of Siderophile

Elements and Core-Mantle Segregation / Kevin Righter -- Mechanisms and Geochemical Models of Core Formation / David C Rubie, Seth A Jacobson -- Phase Diagrams and Thermodynamics of Core Materials / Andrew J Campbell -- Chemistry of Core-Mantle Boundary / John W Hernlund -- Phase Transition and Melting in the Deep Lower Mantle / Kei Hirose -- Chemistry of the Lower Mantle / Daniel J Frost, Robert Myhill -- Phase Diagrams and Thermodynamics of Lower Mantle Materials / Susannah M Dorfman -- Volatiles in Deep Interior. Hydrogen in the Earth's Core / Caitlin A Murphy -- Stability of Hydrous Minerals and Water Reservoirs in the Deep Earth Interior / Eiji Ohtani, Yohei Amaike, Seiji Kamada, Itaru Ohira, Izumi Mashino -- Carbon in the Core / Bin Chen, Jie Li

In 438 alphabetically-arranged essays, this work provides a useful overview of the core mathematical background for nonlinear science, as well as its applications to key problems in ecology and biological systems, chemical reaction-diffusion problems, geophysics, economics, electrical and mechanical oscillations in engineering systems, lasers and nonlinear optics, fluid mechanics and turbulence, and condensed matter physics, among others.

Fluid and flow problems in porous media have attracted the attention of industrialists, engineers and scientists from varying disciplines, such as chemical, environmental, and mechanical engineering, geothermal physics and food science. There has been a increasing interest in heat and fluid flows through porous media, making this book a timely and appropriate resource. Each chapter is systematically detailed to be easily grasped by a research worker with basic knowledge of fluid mechanics, heat transfer and computational and experimental methods. At the same time, the readers will be informed of the most recent research literature in the field, giving it dual usage as both a post-grad text book and professional reference. Written by the recent directors of the NATO Advanced Study Institute session on 'Emerging Technologies and Techniques in Porous Media' (June 2003), this book is a timely and essential reference for scientists and engineers within a variety of fields.

Thermodiffusion in Multicomponent Mixtures presents the computational approaches that are employed in the study of thermodiffusion in various types of mixtures, namely, hydrocarbons, polymers, water-alcohol, molten metals, and so forth. We present a detailed formalism of these methods that are based on non-equilibrium thermodynamics or algebraic correlations or principles of the artificial neural network. The book will serve as single complete reference to understand the theoretical derivations of thermodiffusion models and its application to different types of multi-component mixtures. An exhaustive discussion of these is used to give a complete perspective of the principles and the key factors that govern the thermodiffusion process.

This book covers the experimental and theoretical study of convection in non-isothermal ferro-nanofluids (FNFs). Since FNFs are not transparent and magnetic fields are very sensitive to the shape of the boundary between magnetic and nonmagnetic media, special flow visualization techniques based on the use of thermo-sensitive liquid crystal films, infrared cameras, as well as local and integral temperature sensors are discussed in the book. This book considers several major configurations of convective chambers and the applied magnetic field. For each of them, the stability boundaries are determined theoretically and experimentally. The physical types of dominant instabilities and the characteristics of their interactions are subsequently established using linear and weakly non-linear hydrodynamic stability analyses and elements of bifurcation theory. The book also discusses the potential of using magnetically controlled ferro-nanofluids as a heat carrier in situations where heat removal by natural convection is not possible due to the lack of gravity (orbital stations) or extreme confinement (microelectronics). Researchers and practitioners working in the areas of fluid mechanics, hydrodynamic stability, and heat and mass transfer will benefit from this

book.

Mind over Magma chronicles the scientific effort to unravel the mysteries of rocks that solidified on or beneath Earth's surface from the intensely hot, molten material called magma. The first-ever comprehensive history of the study of such igneous rocks, it traces the development of igneous petrology from ancient descriptions of volcanic eruptions to recent work incorporating insights from physical chemistry, isotope studies, and fluid dynamics. Intellectual developments in the field--from the application of scientific methods to the study of rocks to the discovery of critical data and the development of the field's major theories--are considered within their broader geographical, social, and technological contexts. Mind over Magma examines the spread of igneous petrology from western Europe to North America, South Africa, Japan, Australia, and much of the rest of the world. It considers the professionalization and Anglicization of the field, detailing changes in publication outlets, the role of women, and the influence of government funding. The book also highlights the significant role that technological developments--including the polarizing microscope, high-temperature quenching furnaces, and instrumental analysis--have played in the discovery of new data and development of revolutionary insights into the nature of igneous rocks. Both an engagingly told story and a major reference, Mind over Magma is the only available history of this important field. As such, it will be appreciated by petrologists, geochemists, and other geologists as well as by those interested in the history of science.

For a food product to be a success in the marketplace it must be stable throughout its shelf-life. Quality deterioration due to chemical changes and alterations in condition due to physical instability are not always recognised, yet can be just as problematic as microbial spoilage. This book provides an authoritative review of key topics in this area. Chapters in part one focus on the chemical reactions which can negatively affect food quality, such as oxidative rancidity, and their measurement. Part two reviews quality deterioration associated with physical changes, such as moisture loss, gain and migration, crystallization and emulsion breakdown. Contributions in the following section outline the likely effects on different foods and beverages, including bakery products, fruit and vegetables, ready-to-eat meals and wine. With contributions from leaders in their fields, Chemical deterioration and physical instability of food and beverages is an essential reference for R&D and QA staff in the food industry and researchers with an interested in this subject. Examines chemical reactions which can negatively affect food quality and measurement Reviews quality deterioration associated with physical changes such as moisture loss, gain and migration, and crystallization Documents deterioration in specific food and beverage products including bakery products, frozen foods and wine

Optical and Molecular Physics: Theoretical Principles and Experimental Methods addresses many important applications and advances in the field. This book is divided into 5 sections: Plasmonics and carbon dots physics with applications Optical films, fibers, and materials Optical properties of advanced materials Molecular physics and diffusion Macromolecular physics Weaving together science and engineering, this new volume addresses important applications and advances in optical and molecular physics. It covers plasmonics and carbon dots physics with applications; optical films, fibers, and materials; optical properties of advanced materials; molecular physics and

diffusion; and macromolecular physics. This book looks at optical materials in the development of composite materials for the functionalization of glass, ceramic, and polymeric substrates to interact with electromagnetic radiation and presents state-of-the-art research in preparation methods, optical characterization, and usage of optical materials and devices in various photonic fields. The authors discuss devices and technologies used by the electronics, magnetics, and photonics industries and offer perspectives on the manufacturing technologies used in device fabrication.

Micropolar fluids are fluids with microstructure. They belong to a class of fluids with nonsymmetric stress tensor that we shall call polar fluids, and include, as a special case, the well-established Navier-Stokes model of classical fluids that we shall call ordinary fluids. Physically, micropolar fluids may represent fluids consisting of rigid, randomly oriented (or spherical) particles suspended in a viscous medium, where the deformation of fluid particles is ignored. The model of micropolar fluids introduced in [65] by C. A. Eringen is worth studying as a very well balanced one. First, it is a well-founded and significant generalization of the classical Navier-Stokes model, covering, both in theory and applications, many more phenomena than the classical one. Moreover, it is elegant and not too complicated, in other words, man ageable to both mathematicians who study its theory and physicists and engineers who apply it. The main aim of this book is to present the theory of micropolar fluids, in particular its mathematical theory, to a wide range of readers. The book also presents two applications of micropolar fluids, one in the theory of lubrication and the other in the theory of porous media, as well as several exact solutions of particular problems and a numerical method. We took pains to make the presentation both clear and uniform.

This is a comprehensive and self-contained introduction to the mathematical problems of thermal convection. The book delineates the main ideas leading to the authors'' variant of the energy method. These can be also applied to other variants of the energy method. The importance of the book lies in its focussing on the best concrete results known in the domain of fluid flows stability and in the systematic treatment of mathematical instruments used in order to reach them. Sample Chapter(s). Introduction (121 KB). Chapter 1: Mathematical models governing fluid flows stability (640 KB). Contents: Mathematical Models Governing Fluid Flows Stability; Incompressible Navier-Stokes Fluid; Elements of Calculus of Variations; Variants of the Energy Method for Non-Stationary Equations; Applications to Linear B(r)nard Convections; Variational Methods Applied to Linear Stability; Applications of the Direct Method to Linear Stability. Readership: Researchers in applied mathematics and condensed matter physics (thermodynamics).

This book deals with density, temperature, velocity and concentration fluctuations in fluids and fluid mixtures. The book first reviews thermal fluctuations in equilibrium fluids on the basis of fluctuating hydrodynamics. It then shows how the method of fluctuating hydrodynamics can be extended to deal with hydrodynamic fluctuations when the system is in a stationary nonequilibrium state. In contrast to equilibrium fluids where the fluctuations are generally short ranged unless the system is close to a critical point, fluctuations in nonequilibrium fluids are always long-ranged encompassing the entire system. The book provides the first comprehensive treatment of fluctuations in fluids and fluid mixtures brought out of equilibrium by the imposition of a temperature and concentration gradient but that are still in a macroscopically quiescent state. By

incorporating appropriate boundary conditions in the case of fluid layers, it is shown how fluctuating hydrodynamics affects the fluctuations close to the onset of convection. Experimental techniques of light scattering and shadowgraphy for measuring nonequilibrium fluctuations are elucidated and the experimental results thus far reported in the literature are reviewed. · Systematic exposition of fluctuating hydrodynamics and its applications · First book on nonequilibrium fluctuations in fluids · Fluctuating Boussinesq equations and nonequilibrium fluids · Fluid layers and onset of convection · Rayleigh scattering and Brillouin scattering in fluids · Shadowgraph technique for measuring fluctuations · Fluctuations near hydrodynamic instabilities
This book is one of the first devoted to an account of theories of thermal convection which involve local thermal non-equilibrium effects, including a concentration on microfluidic effects. The text introduces convection with local thermal non-equilibrium effects in extraordinary detail, making it easy for readers newer to the subject area to understand. This book is unique in the fact that it addresses a large number of convection theories and provides many new results which are not available elsewhere. This book will be useful to researchers from engineering, fluid mechanics, and applied mathematics, particularly those interested in microfluidics and porous media.
Enables readers to apply transport phenomena principles to solve advanced problems in all areas of engineering and science This book helps readers elevate their understanding of, and their ability to apply, transport phenomena by introducing a broad range of advanced topics as well as analytical and numerical solution techniques. Readers gain the ability to solve complex problems generally not addressed in undergraduate-level courses, including nonlinear, multidimensional transport, and transient molecular and convective transport scenarios. Avoiding rote memorization, the author emphasizes a dual approach to learning in which physical understanding and problem-solving capability are developed simultaneously. Moreover, the author builds both readers' interest and knowledge by: Demonstrating that transport phenomena are pervasive, affecting every aspect of life Offering historical perspectives to enhance readers' understanding of current theory and methods Providing numerous examples drawn from a broad range of fields in the physical and life sciences and engineering Contextualizing problems in scenarios so that their rationale and significance are clear This text generally avoids the use of commercial software for problem solutions, helping readers cultivate a deeper understanding of how solutions are developed. References throughout the text promote further study and encourage the student to contemplate additional topics in transport phenomena. Transport Phenomena is written for advanced undergraduates and graduate students in chemical and mechanical engineering. Upon mastering the principles and techniques presented in this text, all readers will be better able to critically evaluate a broad range of physical phenomena, processes, and systems across many disciplines.
Instability of flows and their transition to turbulence are widespread phenomena in engineering and the natural environment, and are important in applied mathematics, astrophysics, biology, geophysics, meteorology, oceanography and physics as well as engineering. This is a textbook to introduce these phenomena at a level suitable for a graduate course, by modelling them mathematically, and describing numerical simulations and laboratory experiments. The visualization of instabilities is emphasized, with many figures, and in references to more still and moving pictures. The relation of

chaos to transition is discussed at length. Many worked examples and exercises for students illustrate the ideas of the text. Readers are assumed to be fluent in linear algebra, advanced calculus, elementary theory of ordinary differential equations, complex variables and the elements of fluid mechanics. The book is aimed at graduate students but will also be very useful for specialists in other fields.

Both of the authors of this book are disciples and collaborators of the Brussels school of thermodynamics. Their particular domain of competence is the application of numerical methods to the many highly nonlinear problems which have arisen in the context of recent developments in the thermodynamics of irreversi ble processes: stability of states far from equilibrium, search for marginal critical states, bifwrcation phenomena, multiple stationnary states, dissipative structures, etc. These problems cannot in general be handled using only the clas sical and mathematically rigorous methods of the theory of differential, partial differential, and int~grodifferential equations. The present authors demonstrate how approximate methods, re lyi ng usually on powerful computers, lead to significant progress in these areas, if one is prepa red to accept a certain lack of rigor, such as, for example, the lack of proof for the convergence of the series used in the context of problems which are not self adjoint, nor even linear. The results thus obtained must consequently be submit ted to an exacting confrontation with experimental observations. - Even though, the '1 imited information obtained concerning the, often unsuspec ted, mechanisms underlying the observed phenomena is both precious and frequently sufficient. This information results from the properties of the trial functions best suited to the constraints of the problem such as the initial, boundary, and "feedback" conditions, and the analysis of their behavior in the course of the evolution of the system.

Hydrodynamic stability is of fundamental importance in the mechanics of fluids and is mainly concerned with the problem of the transition to turbulence. This book is devoted to publication of original research papers, research-expository and survey articles with an emphasis on unsolved problems and open questions in the mathematical modeling and computational aspects of hydrodynamic stability. Review chapters on the mathematical modeling and numerical simulation aspects of hydrodynamic stability, the physical background, and the limitations of the modeling and simulation procedures, due to particular mathematical or computational methods used, are included. This book will be appropriate for use in research and in research-related courses on the subject. It includes chapters on bifurcations in fluid systems, flow patterns, channel flows, non-parallel shear flows, thin-film flows, strong viscous shear flows, Gortler vortices, bifurcations in convection, wavy film flows and boundary layers.

Handbook of Porous MediaCRC Press

Glycols—Advances in Research and Application: 2012 Edition is a ScholarlyEditions™ eBook that delivers timely, authoritative, and comprehensive information about Glycols. The editors have built Glycols—Advances in Research and Application: 2012 Edition on the vast information databases of ScholarlyNews.™ You can expect the information about Glycols in this eBook to be deeper than what you can access anywhere else, as well as consistently reliable, authoritative, informed, and relevant. The content of Glycols—Advances in Research and Application: 2012 Edition has been produced by the world’s leading scientists, engineers, analysts, research institutions, and companies. All of the content is from peer-reviewed sources, and all of it is written,

assembled, and edited by the editors at ScholarlyEditions™ and available exclusively from us. You now have a source you can cite with authority, confidence, and credibility. More information is available at http://www.ScholarlyEditions.com/.

Plasmonics is an important branch of optics concerned with the interaction of metals with light. Under appropriate illumination, metal nanoparticles can exhibit enhanced light absorption, becoming nanosources of heat that can be precisely controlled. This book provides an overview of the exciting new field of thermoplasmonics and a detailed discussion of its theoretical underpinning in nanophotonics. This topic has developed rapidly in the last decade, and is now a highly-active area of research due to countless applications in nanoengineering and nanomedicine. These important applications include photothermal cancer therapy, drug and gene delivery, nanochemistry and photothermal imaging. This timely and self-contained text is suited to all researchers and graduate students working in plasmonics, nano-optics and thermal-induced processes at the nanoscale.

Compositional Grading in Oil and Gas Reservoirs offers instruction, examples, and case studies on how to answer the challenges of modeling a compositional gradient subject. Starting with the basics on PVT analysis, applied thermodynamics, and full derivations of irreversible thermodynamic-based equations, this critical reference explains gravity-modified equations to be applied to reservoirs, enabling engineers to obtain fluid composition at any point of the reservoir from measured data to create a stronger model calibration. Once model-parameters are re-estimated, new sensibility can be acquired for more accurate modeling of composition, aiding engineers with stronger production curves, reserve estimations, and design of future development strategies. Multiple examples and case studies are included to show the application of the theory from very simple to more complex systems, such as actual reservoirs influenced by thermal diffusion and gravity simultaneously. Other example include a layer for which asphaltene precipitation takes place in the reservoir and three –phase flash algorithms for liquid-liquid-vapor equilibrium calculations, detailing the techniques necessary to ensure convergence. The book combines practical studies with the importance in modeling more complex phenomena, filling a gap for current and upcoming reservoir engineers to expand on solutions and make sense of their reservoir’s output results. Presents a deeper level of detail on the heterogeneity composition and thermo-physical properties of petroleum fluids in the reservoir Includes tactics on how to Increase reliability of reservoir simulation initialization, with practice examples at the end of each chapter Helps readers make sense of compositional grading, with coverage on both theory and application that fulfill a gap in research on reservoir simulation