Cellular And Porous Materials Thermal Properties

Engineers and scientists alike will find this book to be an excellent introduction to the topic of porous materials, in particular the three main groups of porous materials: porous metals, porous ceramics, and polymer foams. Beginning with a general introduction to porous materials, the next six chapters focus on the processing and applications of each of the three main materials groups. The book includes such new processes as gel-casting and freeze-drying for porous ceramics and self-propagating high temperature synthesis (SHS) for porous metals. The applications discussed are relevant to a wide number of fields and industries, including aerospace, energy, transportation, construction, electronics, biomedical and others. The book concludes with a chapter on characterization methods for some basic parameters of porous materials. Porous Materials: Processing and Applications is an excellent resource for academic and industrial researchers in porous materials, as well as for upper-level undergraduate and graduate students in materials science and engineering, physics, chemistry, mechanics, metallurgy, and related specialties. A comprehensive overview of processing and applications of porous materials – provides younger researchers, engineers and students with the best introduction to this class of materials Includes three full chapters on modern applications - one for each of the three main groups of porous materials Introduces readers to several characterization methods for porous materials, including methods for characterizing pore size, thermal conductivity, electrical resistivity and specific surface area

Addresses a Growing Need for the Development of Cellular and Porous Materials in Industry Building blocks used by nature are motivating researchers to create bio-inspired cellular structures that can be used in the development of products for the plastic, food, and biomedical industry. Representing a unified effort by international experts, Biofoams: Science and Applications of Bio-Based Cellular and Porous Materials highlights the latest research and development of biofoams and porous systems, and specifically examines the aspects related to the formation of gas bubbles in drink and food. The book offers a detailed analysis of bio-polymers and foaming technologies, biodegradable and sustainable foams, biomedical foams, food foams, and bio-inspired foams. Explores the Generation of New Materials with Wide-Ranging Technological Applicability This book introduces the science, technologies, and applications related to the use of biopolymers and biomaterials in the development of porous structures. It presents topics that include bio-based polymers for the development of biodegradable and sustainable polymeric foams, foams in food, foams in biomedical applications, biohybrids, and bio-inspired cellular and porous systems. It also includes recent studies on the design of polymer-based composites and hybrid scaffolds, weighs in on the challenges related to the production of porous polymers, and presents relevant examples of cellular architecture present in nature. In addition, this book: Focuses on materials compatible with natural tissues Discusses the engineering of bio-inspired scaffolds with the ability to mimic living tissue Reveals how to use renewable resources to develop more sustainable lightweight materials Illustrates the state of the art of porous scaffold and process techniques A book dedicated to material science, Biofoams: Science and Applications of Bio-Based Cellular and Porous Materials focuses on food technology, polymers and composites, biomedical, and chemical engineering, and examines how the principles used in the creation of cellular structures can be applied in modern industry.

This book discusses multiways in the porous materials. It involves materials with a large number of holes, and it highlights the synthesis, structure, and surface properties of porous materials closely related to more applications, such as support, catalyst, energy storage, chemical reactions, and optical applications. It studies the effect of the filling materials, the thermal treatments, and the porous density in the improvement of physical properties, electrical and energy efficiency, and the generation of new materials. Some synthetic process will be discussed with the effect of some parameters on the final characteristics of the prepared porous structures.

This four-volume handbook gives a state-of-the-art overview of porous materials, from synthesis and characterization and simulation all the way to manufacturing and industrial applications. The editors, coming from academia and industry, are known for their didactic skills as well as their technical expertise. Coordinating the efforts of 37 expert authors in 14 chapters, they construct the story of porous carbons, ceramics, zeolites and polymers from varied viewpoints: surface and colloidal science, materials science, chemical engineering, and energy engineering. Volumes 1 and 2 cover the fundamentals of preparation, characterisation, and simulation of porous materials. Working from the fundamentals all the way to the practicalities of industrial production processes, the subjects include hierarchical materials, in situ and operando characterisation using NMR, X-Ray scattering and tomography, state-of-the-art molecular simulations of adsorption and diffusion in crystalline nanoporous materials, as well as the emerging areas of bio-artificing and drug delivery. Volume 3 focuses on porous materials in industrial separation applications, including adsorption separation, membrane separation, and osmotic distillation. Finally, and highly relevant to tomorrow's energy challenges, Volume 4 explains the energy engineering aspects of applying porous materials in supercapacitors, fuel cells, batteries, electrolysers and sub-surface energy applications.The text contains many high-quality colourful illustrations and examples, as well as thousands of up-to-date references to peer-reviewed articles, reports and websites for further reading. This comprehensive and well-written handbook is a must-have reference for universities, research groups and companies working with porous materials.Related Link(s)

Advances in Intelligent Systems and Computing V

With Particular Emphasis on the Influence of Temperature and Moisture Content on the Thermal Conductivity of Cellular Concrete

Heat Transfer in Multi-Phase Materials

Thermal Transport in Porous Media with Application to Fuel Cell Diffusion Media and Metal Foams

Structure and Properties

The very first major reference text on this topic, this book provides a unique collection of articles reviewing the state of the art in the field. It gives particular emphasis to emerging technologies, from bioengineering and bio-tissues to nanotechnology. The integration of the different topics is presented via a combination of theoretical and applied methodology to provide a self-contained major reference that is appealing to both the scientist and the engineer.

This book provides a profound understanding, which physical processes and mechanisms cause the heat transfer in composite and cellular materials. It shows models for all important classes of composite materials and introduces into the latest advances. In three parts, the book covers Composite Materials (Part A), Porous and Cellular Materials (Part B) and the appearance of a conjoint solid phase and fluid aggregate (Part C).

Transport phenomena in high porosity open-cell fibrous structures have been the focus of many recent industrial and academic investigations. Unique features of these structures such as relatively low cost, ultra-low density, high surface area to volume ratio, and the ability to mix the passing fluid make them excellent candidates for a variety of thermofluid applications including fuel cells, compact heat exchangers and cooling of microelectronics. This thesis contributes to improved understanding of thermal transport phenomena in fuel cell gas diffusion layers (GDLs) and metal foams and describes new experimental techniques and analytic models to characterize and predict effective transport properties. Heat transfer through the GDL is a key process in the design and operation of a proton exchange membrane (PEM) fuel cell. The analysis of this process requires determination of the effective thermal conductivity as well as the thermal contact resistance (TCR) associated with the interface between the GDL and adjacent surfaces/layers. The effective thermal conductivity significantly differs in through-plane and in-plane directions due to anisotropy of the GDL micro-structure. Also, the high porosity of GDLs makes the contribution of TCR against the heat flow through the medium more pronounced. A test bed was designed and built to measure the thermal contact resistance and effective thermal conductivity in both through-plane and in-plane directions under vacuum and ambient conditions. The developed experimental program allows the separation of effective thermal conductivity and thermal contact resistance. For GDLs, measurements are performed under a wide range of compressive loads using Toray carbon paper samples. To study the effect of cyclic compression, which may happen during the operation of a fuel cell stack, measurements are performed on the thermal and structural properties of GDL at different loading-unloading cycles. The static compression measurements are complemented by a compact analytical model that achieves good agreement with experimental data. The outcomes of the cyclic compression measurements show a significant hysteresis in the loading and unloading cycle data for total thermal resistance, TCR, effective thermal conductivity, thickness, and porosity. It is found that after 5 loading/unloading cycles, the geometrical, mechanical, and thermal parameters reach a "steady-state" condition and remain unchanged. A key finding of this study is that the TCR is the dominant component of the GDL total thermal resistance with a significant hysteresis resulting in up to a 34 % difference between the loading and unloading cycle data. Neglecting this phenomenon may result in significant errors in evaluating heat transfer rates and temperature distributions. In-plane thermal experiments were performed using Toray carbon paper samples with different polytetrafluoroethylene (PTFE) content at the mean temperature of 65-70°C. The measurements are complemented by a compact analytical model that achieves good agreement with experimental data ...

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

Handbook Of Porous Materials: Synthesis, Properties, Modeling And Key Applications (In 4 Volumes)

Cellular Ceramics

Emerging Technologies

Proceedings of the 22nd International Conference on Computational Mechanics and Modern Applied Software Systems (CMMASS 2021)

Numerical Analysis of Heat and Mass Transfer in Porous Media

This book is a collection of peer-reviewed best selected research papers presented at 22nd International Conference on Computational Mechanics and Modern Applied Software Systems (CMMASS 2021), held at the Alushta Health and Educational Center, The Republic of Crimea, during 4–13 September 2021. The proceedings is dedicated to solving the real-world problems of applied mechanics using smart computational technology. Physical and mathematical models, numerical methods, computational algorithms and software complexes are discussed, which allow to carry out high-precision mathematical modelling in fluid, gas and plasma mechanics, in general mechanics, deformable solid mechanics, in strength, destruction and safety of structures, etc. Smart technologies and software systems that provide effective solutions to the problems at various multi scale-levels are considered. Special attention is paid to the training of highly qualified specialists for the aviation and space industry.

The development of porous ceramic materials has brought a new challenge to a variety of industries because porous ceramics are more durable in severe environments and their surface characteristics

permit them to satisfy specific functional purposes. With the growing demands of porous ceramics for industrial applications, a number of technologies have been developed to fabricate these materials with an attempt to control their pore characters, as well as to realize the pore-related properties in order to gain a deeper understanding of the relation between the various pore-related properties for optimization purposes.

This book provides an overview of the field of flow and heat transfer in porous medium and focuses on presentation of a generalized approach to predict drag and convective heat transfer within porous medium of arbitrary microscopic geometry, including reticulated foams and packed beds. Practical numerical methods to solve natural convection problems in porous media will be presented with illustrative applications for filtrations, thermal storage and solar receivers.

Cellular ceramics are a specific class of porous materials which includes among others foams, honeycombs, connected fibers, robocast structures and assembled hollow spheres. Because of their particular structure, cellular ceramics display a wide variety of specific properties which make them indispensable for various engineering applications. An increasing number of patents, scientific literature and international conferences devoted to cellular materials testifies to a rapidly growing interest of the technical community in this topic. New applications for cellular ceramics are constantly being put under development. The book, authored by leading experts in this emerging field, gives an overview of the main aspects related to the processing of diverse cellular ceramic structures, methods of structural and properties characterisation and well established industrial, novel and potential applications. It is an introduction to newcomers in this research area and allows students to obtain an in-depth knowledge of basic and practical aspects of this fascinating class of advanced materials.

Biofoams

Emerging Topics in Heat and Mass Transfer in Porous Media

Convective Heat Transfer in Porous Media

Workshop on Heat and Mass Transfer in Porous Media

From Bioengineering and Microelectronics to Nanotechnology

This book provides recent advances in research on drying of particulate and porous materials. It is based on a selection of papers presented at the XI Polish Drying Symposium 2005. The contributions cover theoretical, as well as experimental and modeling research on heat and mass transfer processes during drying of porous material and fluidized beds. The book is a pioneering contribution to the science and technology of drying of particulate solids.

Convective heat tranfer is the result of fluid flowing between objects of different temperatures. Thus it may be the objective of a process (as in refrigeration) or it may be an incidental aspect of other processes. This monograph reviews in a concise and unified manner recent contributions to the principles of convective heat transfer for single- and multi-phase systems: It summarizes the role of the fundamental mechanism, discusses the governing differential equations, describes approximation schemes and phenomenological models, and examines their solutions and applications. After a review of the basic physics and thermodynamics, the book divides the subject into three parts. Part 1 deals with single-medium transfer, specifically with intraphase transfers in single-phase flows and with intramedium transfers in two-phase flows. Part 2 deals with fluid-solid transfer processes, both in cases where the interface is small and in cases where it is large, as well as liquid-liquid transfer processes. Part 3 considers three media, addressing both liquid-solid-solid and gas-liquid-solid systems.

Providing the reader with a solid understanding of the fundamentals as well as an awareness of recent advances in properties and applications of cellular and porous materials, this handbook and ready reference covers all important analytical and numerical methods for characterizing and predicting thermal properties. In so doing it directly addresses the special characteristics of foam-like and hole-riddled materials, combining theoretical and experimental aspects for characterization purposes.

Studies of fluid flow and heat transfer in a porous medium have been the subject of continuous interest for the past several decades because of the wide range of applications, such as geothermal systems, drying technologies, production of thermal isolators, control of pollutant spread in groundwater, insulation of buildings, solar power collectors, design of nuclear reactors, and compact heat exchangers, etc. There are several models for simulating porous media such as the Darcy model, Non-Darcy model, and non-equilibrium model. In porous media applications, such as the environmental impact of buried nuclear heat-generating waste, chemical reactors, thermal energy transport/storage systems, the cooling of electronic devices, etc., a temperature discrepancy between the solid matrix and the saturating fluid has been observed and recognized.

Fluid Flow and Heat Transfer in Porous Media Manufactured by a Space Holder Method

Modeling Approaches to Natural Convection in Porous Media

Modeling Transport Phenomena in Porous Media with Applications

Fabrication, Characterization, Applications

Porous Materials

Cellular solids include engineering honeycombs and foams (which can now be made from polymers, metals, ceramics, and composites) as well as natural materials, such as wood, cork, and cancellous bone. This new edition of a classic work details current understanding of the structure and mechanical behavior of cellular materials, and the ways in which they can be exploited in engineering design. Gibson and Ashby have brought the book completely up to date, including new work on processing of metallic and ceramic foams and on the mechanical, electrical and acoustic properties of cellular solids. Data for commercially available foams are presented on material property charts; two new case studies show how the charts are used for selection of foams in engineering design. Over 150 references appearing in the literature since the publication of the first edition are cited. It will be of interest to graduate students and researchers in materials science and engineering.

Heat and Mass Transfer in Drying of Porous Media offers a comprehensive review of heat and mass transfer phenomena and mechanisms in drying of porous materials. It covers pore-scale and macro-scale models, includes various drying technologies, and discusses the drying dynamics of fibrous porous material, colloidal porous media and size-distributed particle system. Providing guidelines for mathematical modeling and design as well as optimization of drying of porous material, this reference offers useful information for researchers and students as well as engineers in drying technology, food processes, applied energy, mechanical, and chemical engineering.

The performance, reliability and durability of fuel cells are strongly influenced by the operating conditions, especially temperature and compression. Adequate thermal and water management of fuel cells requires knowledge of the thermal bulk and interfacial resistances of all involved components. The porous, brittle and anisotropic nature of most fuel cell components, together with the micro/nano-sized structures, has made it challenging to study their transport properties and thermal behavior. The main purpose of this research was to explore, and guide the improvement of, the thermal behavior of fuel cell materials under compression. Thickness-based methods, having the capability of deconvoluting bulk from the contact resistance, were employed to accurately measure the thermal conductivity of several gas diffusion layers (GDLs) with different PTFE loading. The interfacial thermal resistances of these GDLs with adjacent micro porous layer (MPL) and graphite bipolar plate (BPP) were also determined, through both systematic experiments and comprehensive models developed in this work. The thermal conductivity of a coated MPL as a function of compression and that of a Ballard graphite BPP with respect to temperature were also measured and reported in this thesis. Higher values of contact resistance compared to the bulk resistance at low compression and the reduction of GDL thermal conductivity with PTFE loading are among the main findings of this study. The present work also revealed the following novel counter-intuitive facts: (i) contact resistance may decrease with increasing the porosity of the mating porous materials; (ii) the conventional notion that the thermal conductivity of fibrous materials decreases with increasing porosity does not necessarily hold; and (iii) fiber spacing can be as crucial as porosity to the transport properties of fibrous media. The main conclusion is that the equations that are based solely on porosity should be either discarded or used, with caution, over the limited range of conditions under which they have been formulated. Through a series of experiments combined with theoretical analyses, this thesis presents some key data that helps unravel some unexplained trends reported in the literature. It also provides novel insights into the unexplored thermal behavior of fuel cell components and guides the modification of their micro-structures for better heat management of fuel cells.

POROUS PLASTICS A unique book by a well-known polymer scientist on a subject that is trending in plastics/polymer engineering. Porous polymers are materials that are having pores in their design. Porous polymers are important for various fields of application and are used with pores of different sizes, i.e., from macropores to micropores. This book focuses on the issues of porous polymers as well as low molecular compounds that can be introduced in porous polymers. The book begins with a chapter about polymers that are used for porous materials. Here, among others, microporous polymer networks, hyper-crosslinked polymers, and rigid ladder-type porous polymers are detailed. Related issues are also detailed in the subsequent chapters. In the next chapter, the major synthesis methods for porous polymers are described. Then, the properties and material testing methods, such as standards, are described in a chapter. In the following chapters, special fields of applications of porous polymers are described in detail, such as: medical uses, thermal insulation, membranes, separation methods, and other fields of use. Audience The book will be used by plastics engineers, materials scientists and polymer scientists/researchers in both industry and academia./p>

Processing and Applications

Cellular Solids

Selected Papers from the International Conference on Computer Science and Information Technologies, CSIT 2020, September 23-26, 2020, Zbarazh, Ukraine

Porosity

Thermal Conductivity of Porous Media as Related to Freeze-drying

This updated edition of a widely admired text provides a user-friendly introduction to the field that requires only routine mathematics. The book starts with the elements of fluid mechanics and heat transfer, and covers a wide range of applications from fibrous insulation and catalytic reactors to geological strata, nuclear waste disposal, geothermal reservoirs, and the storage of heat-generating materials. As the standard reference in the field, this book will be essential to researchers and practicing engineers, while remaining an accessible introduction for graduate students and others entering the field. The new edition features 2700 new references covering a number of rapidly expanding fields, including the heat transfer properties of nanofluids and applications involving local thermal non-equilibrium and microfluidic effects.

This book is an ensemble of six major chapters, an introduction, and a closure on modeling transport phenomena in porous media with applications. Two of the six chapters explain the underlying theories, whereas the rest focus on new applications. Porous media transport is essentially a multi-scale process. Accordingly, the related theory described in the second and third chapters covers both continuum? and meso?scale phenomena. Examining the continuum formulation imparts rigor to the empirical porous media models, while the mesoscopic model focuses on the physical processes within the pores. Porous media models are discussed in the context of a few important engineering applications. These include biomedical problems, gas hydrate reservoirs, regenerators, and fuel cells. The discussion reveals the strengths and weaknesses of existing models as well as future research directions.

The purpose of this book, Industrial and Technological Applications of Transport in Porous Materials, is to provide a collection of recent contributions in the field of heat and mass transfer in porous media and their industrial and technological applications. The main benefit of the book is that it discusses some of the most important topics related to transport phenomenon in engineering and their future applications. It includes a set of new technological applications in the field of heat and mass transfer phenomena in a porous medium domain, such as, drying technology, filtration, infrared thermography, energy, recycling, etc. At the same time, these topics will be going to the encounter of a variety of scientific and engineering disciplines, such as chemical, civil, agricultural, mechanical engineering, etc. The book is divided in several chapters that intend to be a resume of the current state of knowledge for benefit of professional colleagues.

Providing a comprehensive overview of the radiative behavior and properties of materials, the fifth edition of this classic textbook describes the physics of radiative heat transfer, development of relevant analysis methods, and associated mathematical and numerical techniques. Retaining the salient features and fundamental coverage that have made it popular, Thermal Radiation Heat Transfer, Fifth Edition has been carefully streamlined to omit superfluous material, yet enhanced to update information with extensive references. Includes four new chapters on Inverse Methods, Electromagnetic Theory, Scattering and Absorption by Particles, and Near-Field Radiative Transfer Keeping pace with significant developments, this book begins by addressing the radiative properties of blackbody and opaque materials, and how they are predicted using electromagnetic theory and obtained through measurements. It discusses radiative exchange in enclosures without any radiating medium between the surfaces—and where heat conduction is included within the boundaries. The book also covers the radiative properties of gases and addresses energy exchange when gases and other materials interact with radiative energy, as occurs in furnaces. To make this challenging subject matter easily understandable for students, the authors have revised and reorganized this textbook to produce a streamlined, practical learning tool that: Applies the common nomenclature adopted by the major heat transfer journals Consolidates past material, reincorporating much of the previous text into appendices Provides an updated, expanded, and alphabetized collection of references, assembling them in one appendix Offers a helpful list of symbols With worked-out examples, chapter-end homework problems, and other useful learning features, such as concluding remarks and historical notes, this new edition continues its tradition of serving both as a comprehensive textbook for those studying and applying radiative transfer, and as a repository of vital literary references for the serious researcher.

Foams

Porous Ceramic Materials

Drying of Porous Materials

Cellular and Porous Materials

Thermal Properties Simulation and Prediction

This book focuses on the effects of the material, porosity, pore size and pore shape on flow behaviour and heat transfer in microscale porous media manufactured using a space holder method. It also describes a novel approach to studying flow behaviour in non-transparent materials such as porous metals via flow visualization in transparent media that mimic the porous structure. The book employs a combination of microparticle image velocimetry – a modern, advanced technique – and pressure drop measurement – a more traditional method – that makes the mechanistic study of several phenomena possible. It covers the identification of various flow regimes and their boundaries, velocity profiles on the microscale, the heat transfer coefficient under forced convection, and the correlation between flow behaviour on the pore scale and the convective heat transfer performance of the porous media. Understanding the fundamentals of porous flow, especially on the microscale, is critical for applications of porous media in heat exchangers, catalytic convertors, chemical reactors, filtration and oil extraction. Accordingly, this book offers a valuable resource for all researchers, graduate students and engineers working in the areas of porous flow and porous materials.

Foams are ubiquitous in human life and can be found in a variety of products and materials, such as sodas and sponges. There are liquid foams and solid foams, both of which have distinct properties useful for various applications. This book reviews, researches, and summarizes the potential uses of foam fluids and porous foams in engineering, medicine, and other industries. Chapters discuss different types of foams including multiphase foams, cellular foams, and ceramic foams as well as foam-generating mechanisms and techniques.

This thesis is concerned with developing porous materials from tyre shred residue and polyurethane binder for acoustic absorption and thermal insulation applications. The resultant materials contains a high proportion of open, interconnected cells that are able to absorb incident sound waves through viscous friction, inertia effects and thermal energy exchanges. The materials developed are also able to insulate against heat by suppressing the convection of heat and reduced conductivity of the fluid locked in the large proportion of close-cell pores. The acoustic absorption performance of a porous media is controlled by the number of open cells and pore size distribution. Therefore, this work also investigates the use of catalysts and surfactants to modify the pore structure and studies the influence of the various components in the chemical formulations used to produce these porous materials. An optimum type and amounts of catalyst are selected to obtain a high chemical conversion and a short expanding time for the bubble growth phase. The surfactant is used to reduce the surface tension and achieve a homogenous mixing between the solid particulates tyre shred residue, the water, the catalyst and the binder. It is found that all of the components significantly affect the resultant materials structure and its morphology. The results show that the catalyst has a particularly strong effect on the pore structure and the ensuing thermal and acoustical properties. In this research, the properties of the porous materials developed are characterized using standard experimental techniques and the acoustic and thermal insulation performance underpinned using theoretical models. The important observation from this research is that a new class of recycled materials with pore stratification has been developed. It is shown that the pore stratification can have a positive effect on the acoustic absorption in a broadband frequency range. The control of reaction time in the foaming process is a key function that leads to a gradual change in the pore size distribution, porosity, flow resistivity and tortuosity which vary as a function of sample depth. It is shown that the Pade approximation is a suitable model to study the acoustic behaviour of these materials. A good agreement between the measured data and the model was attained.

Focusing on heat transfer in porous media, this book covers recent advances in nano and macro' scales. Apart from introducing heat flux bifurcation and splitting within porous media, it highlights two-phase flow, nanofluids, wicking, and convection in bi-disperse porous media. New methods in modeling heat and transport in porous media, such as pore-scale analysis and Lattice–Boltzmann methods, are introduced. The book covers related engineering applications, such as enhanced geothermal systems, porous burners, solar systems, transpiration cooling in aerospace, heat transfer enhancement and electronic cooling, drying and soil evaporation, foam heat exchangers, and polymer-electrolyte fuel cells.

Heat and Mass Transfer in Porous Media

Thermal Radiation Heat Transfer, 5th Edition

Nanofluid Flow in Porous Media

Industrial and Technological Applications of Transport in Porous Materials

Porous Plastics

Convection in Porous Media, 4th Edition, provides a user-friendly introduction to the subject, covering a wide range of topics, such as fibrous insulation, geological strata, and catalytic reactors. The presentation is self-contained, requiring only routine mathematics and the basic elements of fluid mechanics and heat transfer. The book will be of use not only to researchers and practicing engineers as a review and reference, but also to graduate students and others entering the field. The new edition features approximately 1,750 new references and covers current research in nanofluids, cellular porous materials, strong heterogeneity, pulsating flow, and more.

Porous and Complex Flow Structures in Modern Technologies represents a new approach to the field, considering the fundamentals of porous media in terms of the key roles played by these materials in modern technology. Intended as a text for advanced undergraduates and as a reference for practicing engineers, the book uses the physics of flows in porous materials to tie together a wide variety of important issues from such fields as biomedical engineering, energy conversion, civil engineering, electronics, chemical engineering, and environmental engineering. Thus, for example, flows of water and oil through porous ground play a central role in energy exploration and recovery (oil wells, geothermal fluids), energy conversion (effluents from refineries and power plants), and environmental engineering (leachates from waste repositories). Similarly, the demands of miniaturization in electronics and in biomedical applications are driving research into the flow of heat and fluids through small-scale porous media (heat exchangers, filters, gas exchangers). Filters, catalytic converters, the drying of stored grains, and a myriad of other applications involve flows through porous media. By providing a unified theoretical framework that includes not only the traditional homogeneous and isotropic media but also models in which the assumptions of representative elemental volumes or global thermal equilibrium fail, the book provides practicing engineers the tools they need to analyze complex situations that arise in practice. This volume includes examples, solved problems and an extensive glossary of symbols.

This book, "Heat and Mass Transfer in Porous Media", presents a set of new developments in the field of basic and applied research work on the physical and chemical aspects of heat and mass transfer phenomena in a porous medium domain, as well as related material properties and their measurements. The book contents include both theoretical and experimental developments, providing a self-contained major reference that is appealing to both the scientists and the engineers. At the same time, these topics will encounter of a variety of scientific and engineering disciplines, such as chemical, civil, agricultural, mechanical engineering, etc. The book is divided in several chapters that intend to be a short monograph in which the authors summarize the current state of knowledge for benefit of professionals.

This book reports on new theories and applications in the field of intelligent systems and computing. It covers cutting-edge computational and artificial intelligence methods, advances in computer vision, big data, cloud computing, and computation linguistics, as well as cyber-physical and intelligent information management systems. The respective chapters are based on selected papers presented at the workshop on intelligent systems and computing, held during the International Conference on Computer Science and Information Technologies, CSIT 2020, which was jointly organized on September 23-26, 2020, by the Lviv Polytechnic National University, Ukraine, the Kharkiv National University of Radio Electronics, Ukraine, and the Technical University of Lodz, Poland, under patronage of Ministry of Education and Science of Ukraine. Given its breadth of coverage, the book provides academics and professionals with extensive information and a timely snapshot of the field of intelligent systems, and is sure to foster new discussions and collaborations among different groups.

Acoustic and Thermal Properties of Recycled Porous Media

Porous and Complex Flow Structures in Modern Technologies

Convection in Porous Media

Held at Case Western Reserve University, Cleveland, Ohio, Oct. 14-15, 1974

Science and Applications of Bio-Based Cellular and Porous Materials

Although the empirical treatment of fluid flow and heat transfer in porous media is over a century old, only in the last three decades has the transport in these heterogeneous systems been addressed in detail. So far, single-phase flows in porous media have been treated or at least formulated satisfactorily, while the subject of two-phase flow and the related heat-transfer in porous media is still in its infancy.

This book identifies the principles of transport in porous media and compares the avalaible predictions based on theoretical treatments of various transport mechanisms with the existing experimental results. The theoretical treatment is based on the volume-averaging of the momentum and energy equations with the closure conditions necessary for obtaining solutions. While emphasizing a basic understanding of heat transfer in porous media, this book does not ignore the need for predictive tools; whenever a rigorous theoretical treatment of a phenomena is not avaliable, semi-empirical and empirical treatments are given.

Handbook of Porous Media, Third Edition offers a comprehensive overview of the latest theories on flow, transport, and heat-exchange processes in porous media. It also details sophisticated porous media models which can be used to improve the accuracy of modeling in a variety of practical applications. Featuring contributions from leading experts in their respective fields, this book: Presents the general characteristics and modeling of porous media, such as multiscale modeling of porous media, two-phase flow, compressible porous media, and dispersion in porous media Addresses the fundamental topics of transport in porous media, including theoretical models of transport, membrane transport phenomena, modeling transport properties, and transport in biomedical applications Describes several important aspects of turbulence in porous media, including advances in modeling turbulence phenomena in heterogeneous porous media Explores heat transfer of nanofluids as well as thermal transport in porous media, including forced convection, double diffusive convection, high-heat flux applications, and thermal behavior of poroelastic media Covers geological applications in porous media, including modeling and experimental challenges related to oil fields, CO2 migration, groundwater flows, and velocity measurements Discusses relevant attributes of experimental work or numerical techniques whenever applicable Paving the way for the establishment of multidisciplinary areas of research, Handbook of Porous Media, Third Edition further enhances cooperation between engineers and scientists by providing a valuable reference for addressing some of the most challenging issues in engineering and the hydrogeological, biological, and biomedical sciences.

The purpose of ‘Numerical Analysis of Heat and Mass Transfer in Porous Media’ is to provide a collection of recent contributions in the field of computational heat and mass transfer in porous media. The main benefit of the book is that it discusses the majority of the topics related to numerical transport phenomenon in engineering (including state-of-the-art and applications) and presents some of the most important theoretical and computational developments in porous media and transport phenomenon domain, providing a self-contained major reference that is appealing to both the scientists, researchers and the engineers. At the same time, these topics encounter of a variety of scientific and engineering disciplines, such as chemical, civil, agricultural, mechanical engineering, etc. The book is divided in several chapters that intend to be a resume of the current state of knowledge for benefit of professional colleagues.

Bulk and Interfacial Thermal Transport in Microstructural Porous Materials with Application to Fuel Cells

Process, Technologies and Applications

Handbook of Porous Media

From Macro to Nano Scale Lengths

Advances in Theory and Practice of Computational Mechanics