

Microfluidics And Nanofluidics Handbook Fabrication Implementation And Applications

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Bioinspired Materials for Medical Applications - Lígia Rodrigues 2016-09-24

Bioinspired Materials for Medical Applications examines the inspiration of natural materials and their interpretation as modern biomaterials. With a strong focus on therapeutic and diagnostic applications, the book also examines the development and manipulation of bioinspired materials in regenerative medicine. The first set of chapters is heavily focused on bioinspired solutions for the delivery of drugs and therapeutics that also offer information on the fundamentals of these materials. Chapters in part two concentrate on bioinspired materials for diagnosis applications with a wide coverage of sensor and imaging systems With a broad coverage of the applications of bioinspired biomaterials, this book is a valuable resource for biomaterials researchers, clinicians, and scientists in academia and industry, and all those who wish to broaden their knowledge in the allied field. Explores how materials designed and produced with inspiration from nature can be used to enhance man-made biomaterials and medical devices Brings together the two fields of biomaterials and bioinspired materials Written by a world-class team of research scientists, engineers, and clinicians

Encyclopedia of Microfluidics and Nanofluidics - Dongqing Li 2008-08-06

Covering all aspects of transport phenomena on the nano- and micro-scale, this encyclopedia features over 750 entries in three alphabetically-arranged volumes including the most up-to-date research, insights, and applied techniques across all areas. Coverage includes electrical double-layers, optofluidics, DNC lab-on-a-chip, nanosensors, and more.

Micro/Nanofluidics and Lab-on-Chip Based Emerging Technologies for Biomedical and Translational Research Applications - Part A - 2022-01-13

Micro/Nanofluidics and Lab-on-Chip Based Emerging Technologies for Biomedical and Translational Research Applications, Volume 185, Part A represents the collation of chapters written by eminent scientists worldwide. Chapters in this updated release include An introduction to microfluidics and their applications, Design and fabrication of Micro/Nanofluidics devices and systems, Detection and separation of proteins using Micro/Nanofluidics devices, Micro/Nanofluidics devices for DNA/RNA detection and separation, Paper based microfluidics a forecast towards the most affordable and rapid point-of-care devices, Paper based micro/Nanofluidics devices for biomedical applications, Advances of Microfluidics Devices and their Applications in Personalized Medicine, and much more. Additional chapters cover Microfluidics for single cell analysis, Fluorescence Based Miniaturized Microfluidic and Nanofluidic Systems for Biomedical Applications, Active Matter Dynamics in Confined Microfluidic Environments, Challenges and opportunities in micro/nanofluidics and lab-on-a-chip, and Paper-microfluidic signal-enhanced immunoassays. Offers basic understanding of the state-of-the-art design and fabrication of microfluidics/ nanofluidics and lab-on-chip Explains how to develop microfluidics/nanofluidics for biomedical application such as high throughput biological screening and separation Discusses the applications, challenges and opportunities in biomedical and translational research applications of microfluidics/nanofluidics

Microfluidics and Nanofluidics Handbook, 2 Volume Set - Sushanta K. Mitra 2011-09-20

The Microfluidics and Nanofluidics Handbook: Two-Volume Set comprehensively captures the cross-

disciplinary breadth of micro- and nanofluidics, which encompass the biological sciences, chemistry, physics and engineering applications. To fill the knowledge gap between engineering and the basic sciences, the editors pulled together key individuals, well known in their respective areas, to author chapters that help graduate students, scientists, and practicing engineers understand the overall area of microfluidics and nanofluidics. Highlights Discusses basic microbiology and chemistry related to microfluidics Explains fabrication techniques Emphasizes applications of microfluidics in the energy sector Describes micro-fuel cells and lab-on-a-chip Presents example tables, graphs, and equations Covering physics and transport phenomena along with life sciences and related applications, Volume One: Chemistry, Physics, and Life Science Principles provides readers with the fundamental science background that are required for the study of microfluidics and nanofluidics. Volume Two: Fabrication, Implementation, and Applications focuses on topics related to experimental and numerical methods, followed by chapters on fabrications and other applications, ranging from aerospace to biological systems. Both volumes include as much interdisciplinary knowledge as possible to reflect the inherent nature of this area, making them valuable to students and practitioners.

Nanofluidics - Zhigang Li 2018-11-05

This book provides an introduction to nanofluidics in a simple manner and can be easily followed by senior undergraduate students, graduate students, and other researchers who have some background in fluid mechanics. The book covers the main topics about the fundamentals of nanofluidics and how it differs from classic fluid mechanics. It also describes the methodologies of nanofluidics, including numerical approaches, e.g., molecular dynamics simulation and experimental techniques. Fundamental physics and new phenomena in nanofluidics are the major concerns of this book. The author goes on to discuss nanococonfinements and the parameters that affect the fluid dynamics at the nanoscale and make flow analysis complex. These parameters accommodate rich, new flow phenomena that may not be observed at the macro- and microscale. Although not all of the new phenomena will find widespread applications, the physics underlying these new phenomena may offer insights for other fields. This is one of the reasons why this book emphasizes the mechanisms of various flow fashions. Explores the unique characteristics of nanoscale flows and related properties Reviews the latest research of nanoscale ion transport and its applications Discusses the fluid flows in nanoconfinements in a unique manner based on the author's original research Incorporates important applications of nanofluidics throughout.

Microfluidics and Nanofluidics - Clement Kleinstreuer 2013-12-04

Fluidics originated as the description of pneumatic and hydraulic control systems, where fluids were employed (instead of electric currents) for signal transfer and processing. Microfluidics and Nanofluidics: Theory and Selected Applications offers an accessible, broad-based coverage of the basics through advanced applications of microfluidics and nanofluidics. It is essential reading for upper-level undergraduates and graduate students in engineering and professionals in industry.

Lab-on-a-Chip Devices and Micro-Total Analysis Systems - Jaime Castillo-León 2014-11-05

This book covers all the steps in order to fabricate a lab-on-a-chip device starting from the idea, the design, simulation, fabrication and final evaluation. Additionally, it includes basic theory on microfluidics essential

to understand how fluids behave at such reduced scale. Examples of successful histories of lab-on-a-chip systems that made an impact in fields like biomedicine and life sciences are also provided. This book also: · Provides readers with a unique approach and toolset for lab-on-a-chip development in terms of materials, fabrication techniques, and components · Discusses novel materials and techniques, such as paper-based devices and synthesis of chemical compounds on-chip · Covers the four key aspects of development: basic theory, design, fabrication, and testing · Provides readers with a comprehensive list of the most important journals, blogs, forums, and conferences where microfluidics and lab-on-a-chip news, methods, techniques and challenges are presented and discussed, as well as a list of companies providing design and simulation support, components, and/or developing lab-on-a-chip and microfluidic devices.

Theoretical Microfluidics - Henrik Bruus 2007-09-27

Microfluidics is a young and rapidly expanding scientific discipline, which deals with fluids and solutions in miniaturized systems, the so-called lab-on-a-chip systems. It has applications in chemical engineering, pharmaceuticals, biotechnology and medicine. As the lab-on-a-chip systems grow in complexity, a proper theoretical understanding becomes increasingly important. The basic idea of the book is to provide a self-contained formulation of the theoretical framework of microfluidics, and at the same time give physical motivation and examples from lab-on-a-chip technology. After three chapters introducing microfluidics, the governing equations for mass, momentum and energy, and some basic flow solutions, the following 14 chapters treat hydraulic resistance/compliance, diffusion/dispersion, time-dependent flow, capillarity, electro- and magneto-hydrodynamics, thermal transport, two-phase flow, complex flow patterns and acousto-fluidics, as well as the new fields of opto- and nano-fluidics. Throughout the book simple models with analytical solutions are presented to provide the student with a thorough physical understanding of order of magnitudes and various selected microfluidic phenomena and devices. The book grew out of a set of well-tested lecture notes. It is with its many pedagogical exercises designed as a textbook for an advanced undergraduate or first-year graduate course. It is also well suited for self-study.

Microfluidics for Medical Applications - Albert van den Berg 2014-12-01

Lab-on-a-chip devices for point of care diagnostics have been present in clinics for several years now. Alongside their continual development, research is underway to bring the organs and tissue on-a-chip to the patient, amongst other medical applications of microfluidics. This book provides the reader with a comprehensive review of the latest developments in the application of microfluidics to medicine and is divided into three main sections. The first part of the book discusses the state-of-the-art in organs and tissue on a chip; the second provides a thorough background to microfluidics for medicine, and the third (and largest) section provides numerous examples of point-of-care diagnostics. Written with students and practitioners in mind, and with contributions from the leaders in the field across the globe, this book provides a complete digest of the state-of-the-art in microfluidics medical devices and will provide a handy resource for any laboratory or clinic involved in the development or application of such devices.

Fluid Mechanics Measurements - R. Goldstein 2017-11-13

This revised edition provides updated fluid mechanics measurement techniques as well as a comprehensive review of flow properties required for research, development, and application. Fluid-mechanics measurements in wind tunnel studies, aeroacoustics, and turbulent mixing layers, the theory of fluid mechanics, the application of the laws of fluid mechanics to measurement techniques, techniques of thermal anemometry, laser velocimetry, volume flow measurement techniques, and fluid mechanics measurement in non-Newtonian fluids, and various other techniques are discussed.

Nanotechnology Characterization Tools for Biosensing and Medical Diagnosis - Challa S.S.R. Kumar 2018-12-16

Eighth volume of a 40 volume series on nanoscience and nanotechnology, edited by the renowned scientist Challa S.S.R. Kumar. This handbook gives a comprehensive overview about Nanotechnology Characterization Tools for Biosensing and Medical Diagnosis. Modern applications and state-of-the-art techniques are covered and make this volume an essential reading for research scientists in academia and industry.

Microfluidics and Nanofluidics Handbook - Sushanta K. Mitra 2016-04-19

This comprehensive handbook presents fundamental aspects, fabrication techniques, introductory materials

on microbiology and chemistry, measurement techniques, and applications of microfluidics and nanofluidics. The second volume focuses on topics related to experimental and numerical methods. It also covers fabrication and applications in a variety of areas, from aerospace to biological systems. Reflecting the inherent nature of microfluidics and nanofluidics, the book includes as much interdisciplinary knowledge as possible. It provides the fundamental science background for newcomers and advanced techniques and concepts for experienced researchers and professionals.

NANOTECHNOLOGY AND THE ENVIRONMENT. - 2023

Microfluidics for Single-Cell Analysis - Jin-Ming Lin 2019-08-28

This book summarizes the various microfluidic-based approaches for single-cell capture, isolation, manipulation, culture and observation, lysis, and analysis. Single-cell analysis reveals the heterogeneities in morphology, functions, composition, and genetic performance of seemingly identical cells, and advances in single-cell analysis can overcome the difficulties arising due to cell heterogeneity in the diagnostics for a targeted model of disease. This book provides a detailed review of the state-of-the-art techniques presenting the pros and cons of each of these methods. It also offers lessons learned and tips from front-line investigators to help researchers overcome bottlenecks in their own studies. Highlighting a number of techniques, such as microfluidic droplet techniques, combined microfluidics-mass-spectrometry systems, and nanochannel sampling, it describes in detail a new microfluidic chip-based live single-cell extractor (LSCE) developed in the editor's laboratory, which opens up new avenues to use open microfluidics in single-cell extraction, single-cell mass spectrometric analysis, single-cell adhesion analysis and subcellular operations. Serving as both an elementary introduction and advanced guidebook, this book interests and inspires scholars and students who are currently studying or wish to study microfluidics-based cell analysis methods.

Micro/Nanofluidics and Lab-on-Chip Based Emerging Technologies for Biomedical and Translational Research Applications - Part B - 2022-02-01

Micro/Nanofluidics and Lab-on-Chip Based Emerging Technologies for Biomedical and Translational Research Applications - Part B, Volume 187 represents the collation of chapters written by eminent scientists worldwide. Chapters in this new release include Design and fabrication of microfluidics devices for molecular biology applications, Micro/Nanofluidics devices for drug delivery, From organ-on-chip to body-on-chip: the next generation of microfluidics platforms for in vitro drug toxicity testing, Micro/Nanofluidics for high throughput drug screening, Design, fabrication and assembly of lab-on-a-chip and its uses, Advances in microfluidic 3D cell culture for pre-clinical drug development, Tissue and organ culture on lab-on-a chip for biomedical applications, and much more. Offers a basic understanding of the state-of-the-art design and fabrication of microfluidics/ nanofluidics and lab on chip Explains how to develop microfluidics/nanofluidic for advanced application such as healthcare, high throughout drug screening, 3D cell culture and organ-on-chip Discusses the emerging demands and research of micro/nanofluidic based devices in biomedical and translational research applications

Bio-MEMS - Wanjun Wang 2006-12-15

Microelectromechanical systems (MEMS) are evolving into highly integrated technologies for a variety of application areas. Add the biological dimension to the mix and a host of new problems and issues arise that require a broad understanding of aspects from basic, materials, and medical sciences in addition to engineering. Collecting the efforts of renowned leaders in each of these fields, BioMEMS: Technologies and Applications presents the first wide-reaching survey of the design and application of MEMS technologies for use in biological and medical areas. This book considers both the unique characteristics of biological samples and the challenges of microscale engineering. Divided into three main sections, it first examines fabrication technologies using non-silicon processes, which use materials that are appropriate for medical/biological analyses. These include UV lithography, LIGA, nanoimprinting, injection molding, and hot-embossing. Attention then shifts to microfluidic components and sensing technologies for sample preparation, delivery, and analysis. The final section outlines various applications and systems at the leading edge of BioMEMS technology in a variety of areas such as genomics, drug delivery, and proteomics. Laying a cross-disciplinary foundation for further development, BioMEMS: Technologies and Applications

provides engineers with an understanding of the biological challenges and biological scientists with an understanding of the engineering challenges of this burgeoning technology.

Advances in Microfluidic Technologies for Energy and Environmental Applications - Yong Ren 2020

Microfluidics and Lab-on-a-Chip - Andreas Manz 2020-09-24

Responding to the need for an affordable, easy-to-read textbook that introduces microfluidics to undergraduate and postgraduate students, this concise book will provide a broad overview of the important theoretical and practical aspects of microfluidics and lab-on-a-chip, as well as its applications.

Engineering of Micro/Nano Biosystems - Gregory Barbillon 2020-08-19

This tutorial book offers an in-depth overview of the fundamental principles of micro/nano technologies and devices related to sensing, actuation and diagnosis in fluidics and biosystems. Research in the MEMS/NEMS and lab-on-chip fields has seen rapid growth in both academic and industrial domains, as these biodevices and systems are increasingly replacing traditional large size diagnostic tools. This book is unique in describing not only the devices and technologies but also the basic principles of their operation. The comprehensive description of the fabrication, packaging and principles of micro/nano biosystems presented in this book offers guidance for researchers designing and implementing these biosystems across diverse fields including medical, pharmaceutical and biological sciences. The book provides a detailed overview of the fundamental mechanical, optical, electrical and magnetic principles involved, together with the technologies required for the design, fabrication and characterization of micro/nano fluidic systems and bio-devices. Written by a collaborative team from France and Korea, the book is suitable for academics, researchers, advanced level students and industrial manufacturers.

3D Printed Microfluidic Devices - Savas Tasoglu 2019-01-10

This book is a printed edition of the Special Issue "3D Printed Microfluidic Devices" that was published in *Micromachines*

Microfluidics and Nanofluidics Handbook, Two Volume Set - Sushanta K. Mitra 2011-09-20

The *Microfluidics and Nanofluidics Handbook: Two-Volume Set* comprehensively captures the cross-disciplinary breadth of micro- and nanofluidics, which encompass the biological sciences, chemistry, physics and engineering applications. To fill the knowledge gap between engineering and the basic sciences, the editors pulled together key individuals, w

Sustainable Design and Manufacturing - Steffen G. Scholz 2021-10-19

This book consists of peer-reviewed papers, presented at the International Conference on Sustainable Design and Manufacturing (SDM 2021). Leading-edge research into sustainable design and manufacturing aims to enable the manufacturing industry to grow by adopting more advanced technologies and at the same time improve its sustainability by reducing its environmental impact. Relevant themes and topics include sustainable design, innovation and services; sustainable manufacturing processes and technology; sustainable manufacturing systems and enterprises; and decision support for sustainability. Application areas are wide and varied. The book will provide an excellent overview of the latest developments in the sustainable design and manufacturing area.

Autonomous Sensor Networks - Daniel Filippini 2012-11-27

This volume surveys recent research on autonomous sensor networks from the perspective of enabling technologies that support medical, environmental and military applications. State of the art, as well as emerging concepts in wireless sensor networks, body area networks and ambient assisted living introduce the reader to the field, while subsequent chapters deal in depth with established and related technologies, which render their implementation possible. These range from smart textiles and printed electronic devices to implanted devices and specialized packaging, including the most relevant technological features. The last four chapters are devoted to customization, implementation difficulties and outlook for these technologies in specific applications.

Nanofluidics and Microfluidics - Shaurya Prakash 2014-01-16

To provide an interdisciplinary readership with the necessary toolkit to work with micro- and nanofluidics, this book provides basic theory, fundamentals of microfabrication, advanced fabrication methods, device characterization methods and detailed examples of applications of nanofluidics devices and systems. Case

studies describing fabrication of complex micro- and nanoscale systems help the reader gain a practical understanding of developing and fabricating such systems. The resulting work covers the fundamentals, processes and applied challenges of functional engineered nanofluidic systems for a variety of different applications, including discussions of lab-on-chip, bio-related applications and emerging technologies for energy and environmental engineering. The fundamentals of micro- and nanofluidic systems and micro- and nanofabrication techniques provide readers from a variety of academic backgrounds with the understanding required to develop new systems and applications. Case studies introduce and illustrate state-of-the-art applications across areas, including lab-on-chip, energy and bio-based applications. Prakash and Yeom provide readers with an essential toolkit to take micro- and nanofluidic applications out of the research lab and into commercial and laboratory applications.

Micro- and Nanoscale Fluid Mechanics - Brian J. Kirby 2010-07-26

This text focuses on the physics of fluid transport in micro- and nanofabricated liquid-phase systems, with consideration of gas bubbles, solid particles, and macromolecules. This text was designed with the goal of bringing together several areas that are often taught separately - namely, fluid mechanics, electrostatics, and interfacial chemistry and electrochemistry - with a focused goal of preparing the modern microfluidics researcher to analyse and model continuum fluid mechanical systems encountered when working with micro- and nanofabricated devices. This text serves as a useful reference for practising researchers but is designed primarily for classroom instruction. Worked sample problems are included throughout to assist the student, and exercises at the end of each chapter help facilitate class learning.

Microfluidics and Microfabrication - Suman Chakraborty 2009-12-15

Microfluidics and Microfabrication discusses the interconnect between microfluidics, microfabrication and the life sciences. Specifically, this includes fundamental aspects of fluid mechanics in micro-scale and nano-scale confinements and microfabrication. Material is also presented discussing micro-textured engineered surfaces, high-performance AFM probe-based, micro-grooving processes, fabrication with metals and polymers in bio-micromanipulation and microfluidic applications. Editor Suman Chakraborty brings together leading minds in both fields who also: Cover the fundamentals of microfluidics in a manner accessible to multi-disciplinary researchers, with a balance of mathematical details and physical principles. Discuss the explicit interconnection between microfluidics and microfabrication from an application perspective. Detail the amalgamation of microfluidics with logic circuits and applications in micro-electronics. *Microfluidics and Microfabrication* is an ideal book for researchers, engineers and senior-level graduate students interested in learning more about the two fields.

Microfluidics and Nanofluidics - Mohsen Sheikholeslami Kandelousi 2018-08-22

In the present book, various applications of microfluidics and nanofluidics are introduced. Microfluidics and nanofluidics span a broad array of disciplines including mechanical, materials, and electrical engineering, surface science, chemistry, physics and biology. Also, this book deals with transport and interactions of colloidal particles and biomolecules in microchannels, which have great importance to many microfluidic applications, such as drug delivery in life science, microchannel heat exchangers in electronic cooling, and food processing industry. Furthermore, this book focuses on a detailed description of the thermal transport behavior, challenges and implications that involve the development and use of HTFs under the influence of atomistic-scale structures and industrial applications.

Mechanics Over Micro and Nano Scales - Suman Chakraborty 2011-06-08

Mechanics Over Micro and Nano Scales covers the recent developments in the fields of mechanics in all forms over micro, meso and nano scales. Special emphasis is given to related novel applications and includes fundamental aspects of fluid and solid mechanics, soft matters, scaling laws, and synthetic biology. At the micro and nano scales, realization of many technologically viable ideas relies on the skillful integration of mechanics at macroscopic and molecular levels, both for solids as well as fluids. Research in the related areas is no longer confined to the understanding of the governing the physics of the system, but is also responsible for triggering a technological revolution at small scales. This book also: discusses the fundamentals of mechanics over micro and nano scales in a level accessible to multi-disciplinary researchers, with a balance of mathematical details and physical principles, covers life sciences and chemistry for use in emerging applications related to mechanics over small scales and demonstrates the

explicit interconnection between various scale issues and the mechanics of miniaturized systems. *Mechanics Over Micro and Nano Scales* is an ideal book for researchers and engineers working in mechanics of both solids and fluids.

Advances in Microfluidics - Xiao-Ying Yu 2016-11-23

Increasing innovations and applications make microfluidics a versatile choice for researchers in many disciplines. This book consists of multiple review chapters that aim to cover recent advances and new applications of microfluidics in biology, electronics, energy, and materials sciences. It provides comprehensive views of various aspects of microfluidics ranging from fundamentals of fabrication, flow control, and droplet manipulation to the most recent exploration in emerging areas such as material synthesis, imaging and novel spectroscopy, and marriage with electronics. The chapters have many illustrations showcasing exciting results. This book should be useful for those who are eager to learn more about microfluidics as well as researchers who want to pick up new concepts and developments in this fast-growing field.

Handbook of Photonics in Biomedical Engineering - Donghyun Kim 2015-02-28

Nanophotonics has emerged rapidly into technological mainstream with the advent and maturity of nanotechnology available in photonics and enabled many new exciting applications in the area of biomedical science and engineering that were unimagined even a few years ago with conventional photonic engineering techniques. *Handbook of Nanophotonics in Biomedical Engineering* is intended to be a reliable resource to a wealth of information on nanophotonics that can inspire readers by detailing emerging and established possibilities of nanophotonics in biomedical science and engineering applications. This comprehensive reference presents not only the basics of nanophotonics but also explores recent experimental and clinical methods used in biomedical and bioengineering research. Each peer-reviewed chapter of this book discusses fundamental aspects and materials/fabrication issues of nanophotonics, as well as applications in interfaces, cell, tissue, animal studies, and clinical engineering. The organization provides quick access to current issues and trends of nanophotonic applications in biomedical engineering. All students and professionals in applied sciences, materials, biomedical engineering, and medical and healthcare industry will find this essential reference book highly useful.

Mobile Point-of-Care Monitors and Diagnostic Device Design - Walter Karlen 2018-09-03

Efficient mobile systems that allow for vital sign monitoring and disease diagnosis at the point of care can help combat issues such as rising healthcare costs, treatment delays in remote and resource-poor areas, and the global shortage of skilled medical personnel. Covering everything from sensors, systems, and software to integration, usability, and regulatory challenges, *Mobile Point-of-Care Monitors and Diagnostic Device Design* offers valuable insight into state-of-the-art technologies, research, and methods for designing personal diagnostic and ambulatory healthcare devices. Presenting the combined expertise of contributors from various fields, this multidisciplinary text: Gives an overview of the latest mobile health and point-of-care technologies Discusses portable diagnostics devices and sensors, including mobile-phone-based health systems Explores lab-on-chip systems as well as energy-efficient solutions for mobile point-of-care monitors Addresses computer vision and signal processing for real-time diagnostics Considers interface design for lay healthcare providers and home users *Mobile Point-of-Care Monitors and Diagnostic Device Design* provides important background information about the design process of mobile health and point-of-care devices, using practical examples to illustrate key aspects related to instrumentation, information processing, and implementation.

Micromixers - Nam-Trung Nguyen 2011-09-17

The ability to mix minute quantities of fluids is critical in a range of recent and emerging techniques in engineering, chemistry and life sciences, with applications as diverse as inkjet printing, pharmaceutical manufacturing, specialty and hazardous chemical manufacturing, DNA analysis and disease diagnosis. The multidisciplinary nature of this field - intersecting engineering, physics, chemistry, biology, microtechnology and biotechnology - means that the community of engineers and scientists now engaged in developing microfluidic devices has entered the field from a variety of different backgrounds. Micromixers is uniquely comprehensive, in that it deals not only with the problems that are directly related to fluidics as a discipline (aspects such as mass transport, molecular diffusion, electrokinetic phenomena, flow

instabilities, etc.) but also with the practical issues of fabricating micromixers and building them into microsystems and lab-on-chip assemblies. With practical applications to the design of systems vital in modern communications, medicine and industry this book has already established itself as a key reference in an emerging and important field. The 2e includes coverage of a broader range of fabrication techniques, additional examples of fully realized devices for each type of micromixer and a substantially extended section on industrial applications, including recent and emerging applications. Introduces the design and applications of micromixers for a broad audience across chemical engineering, electronics and the life sciences, and applications as diverse as lab-on-a-chip, ink jet printing, pharmaceutical manufacturing and DNA analysis Helps engineers and scientists to unlock the potential of micromixers by explaining both the scientific (microfluidics) aspects and the engineering involved in building and using successful microscale systems and devices with micromixers The author's applied approach combines experience-based discussion of the challenges and pitfalls of using micromixers, with proposals for how to overcome them

Photoacoustic Imaging and Spectroscopy - Lihong V. Wang 2017-12-19

Photoacoustics promises to revolutionize medical imaging and may well make as dramatic a contribution to modern medicine as the discovery of the x-ray itself once did. Combining electromagnetic and ultrasonic waves synergistically, photoacoustics can provide deep speckle-free imaging with high electromagnetic contrast at high ultrasonic resolution and without any health risk. While photoacoustic imaging is probably the fastest growing biomedical imaging technology, this book is the first comprehensive volume in this emerging field covering both the physics and the remarkable noninvasive applications that are changing diagnostic medicine. Bringing together the leading pioneers in this field to write about their own work, *Photoacoustic Imaging and Spectroscopy* is the first to provide a full account of the latest research and developing applications in the area of biomedical photoacoustics. Photoacoustics can provide functional sensing of physiological parameters such as the oxygen saturation of hemoglobin. It can also provide high-contrast functional imaging of angiogenesis and hypermetabolism in tumors in vivo. Discussing these remarkable noninvasive applications and so much more, this reference is essential reading for all researchers in medical imaging and those clinicians working at the cutting-edge of modern biotechnology to develop diagnostic techniques that can save many lives and just as importantly do no harm.

Microfluidics and Nanofluidics Handbook - Sushanta K. Mitra 2018-03-09

The *Microfluidics and Nanofluidics Handbook: Two-Volume Set* comprehensively captures the cross-disciplinary breadth of the fields of micro- and nanofluidics, which encompass the biological sciences, chemistry, physics and engineering applications. To fill the knowledge gap between engineering and the basic sciences, the editors pulled together key individuals, well known in their respective areas, to author chapters that help graduate students, scientists, and practicing engineers understand the overall area of microfluidics and nanofluidics. Topics covered include Finite Volume Method for Numerical Simulation Lattice Boltzmann Method and Its Applications in Microfluidics Microparticle and Nanoparticle Manipulation Methane Solubility Enhancement in Water Confined to Nanoscale Pores Volume Two: Fabrication, Implementation, and Applications focuses on topics related to experimental and numerical methods. It also covers fabrication and applications in a variety of areas, from aerospace to biological systems. Reflecting the inherent nature of microfluidics and nanofluidics, the book includes as much interdisciplinary knowledge as possible. It provides the fundamental science background for newcomers and advanced techniques and concepts for experienced researchers and professionals.

Paper Microfluidics - Shantanu Bhattacharya 2019-10-08

This volume provides an overview of the recent advances in the field of paper microfluidics, whose innumerable research domains have stimulated considerable efforts to the development of rapid, cost-effective and simplified point-of-care diagnostic systems. The book is divided into three parts viz. theoretical background of paper microfluidics, fabrication techniques for paper-based devices, and broad applications. Each chapter of the book is self-explanatory and focuses on a specific topic and its relation to paper microfluidics and starts with a brief description of the topic's physical background, essential definitions, and a short story of the recent progress in the relevant field. The book also covers the future outlook, remaining challenges, and emerging opportunities. This book shall be a tremendous up-to-date resource for researchers working in the area globally.

Carbon: The Next Silicon? - Marc J. Madou 2016-01-12

Nuclear Magnetic Resonance (NMR) and Electron Spin Resonance (ESR) spectroscopies are well-known characterization techniques that reveal the molecular details of a sample non-invasively. The authors discuss how NMR can provide useful information on the microstructure of carbon and its surface properties and explain how C-MEMS/C-NEMS technology can be explored for building improved NMR microdevices. The authors highlight the manipulation of fluids and particles by dielectrophoresis and the use of carbon electrodes for dielectrophoresis in Lab-on-a-Chip. The use of these electrodes in sample preparation through electrical polarization of a sample for identification, manipulation, and lysis of bioparticles is also discussed and they introduce a new generation of neural prosthetics based on glassy carbon micromachined electrode arrays. The tuning of the electrical, electrochemical and mechanical properties of these patternable electrodes for applications in bio-electrical signal recording and stimulation, and results from in-vivo testing of these glassy carbon microelectrode arrays is reported, demonstrating a quantifiable superior performance compared to metal electrodes.

Microfluidic Devices for Biomedical Applications - Xiujun James Li 2013-10-31

Microfluidics or lab-on-a-chip (LOC) is an important technology suitable for numerous applications from drug delivery to tissue engineering. Microfluidic devices for biomedical applications discusses the fundamentals of microfluidics and explores in detail a wide range of medical applications. The first part of the book reviews the fundamentals of microfluidic technologies for biomedical applications with chapters focussing on the materials and methods for microfabrication, microfluidic actuation mechanisms and digital microfluidic technologies. Chapters in part two examine applications in drug discovery and controlled-delivery including micro needles. Part three considers applications of microfluidic devices in cellular analysis and manipulation, tissue engineering and their role in developing tissue scaffolds and stem cell engineering. The final part of the book covers the applications of microfluidic devices in diagnostic sensing, including genetic analysis, low-cost bioassays, viral detection, and radio chemical synthesis. Microfluidic devices for biomedical applications is an essential reference for medical device manufacturers, scientists and researchers concerned with microfluidics in the field of biomedical applications and life-science industries. Discusses the fundamentals of microfluidics or lab-on-a-chip (LOC) and explores in detail a wide range of medical applications Considers materials and methods for microfabrication, microfluidic actuation mechanisms and digital microfluidic technologies Considers applications of microfluidic devices in cellular analysis and manipulation, tissue engineering and their role in developing tissue scaffolds and stem cell engineering

Optical Nanoscopy and Novel Microscopy Techniques - Peng Xi 2014-09-19

Microscopy is at the forefront of multidisciplinary research. It was developed by physicists, made specific by chemists, and applied by biologists and doctors to better understand how the human body works. For this very reason, the field has been revolutionized in past decades. The objective of Optical Nanoscopy and Novel Microscopy Techniques is to choose some of those revolutionary ideas and serve a general audience from broad disciplines to achieve a fundamental understanding of these technologies and to better apply them in their daily research. The book begins with coverage of super-resolution optical microscopy, which discusses targeted modulation such as STED and SIM or localization methods such as PALM. It then discusses novel development of fluorescent probes, such as organic small-molecule probes, fluorescent proteins, and inorganic labels such as quantum dots. Finally, it describes advanced optical microscopy, such as fluorescence lifetime imaging, fiber optic microscopy, scanning ion conductance microscopy, and the joining of optics and acoustics—photoacoustic microscopy. Following each chapter, a detailed list of references is provided. Problems at the end of each chapter are also included.

Fundamentals and Applications of Microfluidics, Third Edition - Nam-Trung Nguyen 2019-01-31

Now in its Third Edition, the Artech House bestseller, Fundamentals and Applications of Microfluidics, provides engineers and students with the most complete and current coverage of this cutting-edge field. This revised and expanded edition provides updated discussions throughout and features critical new material on microfluidic power sources, sensors, cell separation, organ-on-chip and drug delivery systems, 3D culture devices, droplet-based chemical synthesis, paper-based microfluidics for point-of-care, ion concentration polarization, micro-optofluidics and micro-magnetofluidics. The book shows how to take advantage of the performance benefits of microfluidics and serves as an instant reference for state-of-the-art microfluidics technology and applications. Readers find discussions on a wide range of applications, including fluid control devices, gas and fluid measurement devices, medical testing equipment, and implantable drug pumps. Professionals get practical guidance in choosing the best fabrication and enabling technology for a specific microfluidic application, and learn how to design a microfluidic device. Moreover, engineers get simple calculations, ready-to-use data tables, and rules of thumb that help them make design decisions and determine device characteristics quickly. addressed at the design stage to reduce the risk of failures in the field is presented. The book includes technical details of all state-of-the-art Li-ion energy storage subsystems and their requirements, and provides a system designer a single resource detailing all of the common issues navigated when using Li-ion batteries to reduce the risk of field failures. The book details the various industry standards that are applicable to the subsystems of Li-ion energy storage systems and how the requirements of these standards may impact the design of their system. Checklists are included to help readers evaluate their own battery system designs and identify gaps in the designs that increase the risk of field failures. The book is packed with numerous examples of issues that have caused field failures and how a proper design/assembly process could have reduced the risk of these failures.

Micro/Nano Devices for Blood Analysis - Rui A. Lima 2019-12-03

The development of micro- and nanodevices for blood analysis is an interdisciplinary subject that demands the integration of several research fields, such as biotechnology, medicine, chemistry, informatics, optics, electronics, mechanics, and micro/nanotechnologies. Over the last few decades, there has been a notably fast development in the miniaturization of mechanical microdevices, later known as microelectromechanical systems (MEMS), which combine electrical and mechanical components at a microscale level. The integration of microflow and optical components in MEMS microdevices, as well as the development of micropumps and microvalves, have promoted the interest of several research fields dealing with fluid flow and transport phenomena happening in microscale devices. Microfluidic systems have many advantages over their macroscale counterparts, offering the ability to work with small sample volumes, providing good manipulation and control of samples, decreasing reaction times, and allowing parallel operations in one single step. As a consequence, microdevices offer great potential for the development of portable and point-of-care diagnostic devices, particularly for blood analysis. Moreover, the recent progress in nanotechnology has contributed to its increasing popularity, and has expanded the areas of application of microfluidic devices, including in the manipulation and analysis of flows on the scale of DNA, proteins, and nanoparticles (nanoflows). In this Special Issue, we invited contributions (original research papers, review articles, and brief communications) that focus on the latest advances and challenges in micro- and nanodevices for diagnostics and blood analysis, micro- and nanofluidics, technologies for flow visualization, MEMS, biochips, and lab-on-a-chip devices and their application to research and industry. We hope to provide an opportunity to the engineering and biomedical community to exchange knowledge and information and to bring together researchers who are interested in the general field of MEMS and micro/nanofluidics and, especially, in its applications to biomedical areas.