Capillarity And Wetting Phenomena Drops Bubbles Pearls Waves 1st First Edition

The computer recognition systems are nowadays one of the most promising directions in artificial intelligence. This book is the most comprehensive study of this field. It contains a collection of 78 carefully selected articles contributed by experts of pattern recognition. It reports on current research with respect to both methodology and applications. In particular, it includes the following sections: Biometrics, Features, learning and classifiers, Image processing and computer vision, Knowledge acquisition based on reasoning methods Medical applications, Miscellaneous applications, This book is a great reference tool for scientists who deal with the problems of designing computer pattern recognition systems. Its target readers can be as well researchers as students of computer science, artificial intelligence or robotics.

Superhydrophobic surfaces, artificially mimicking lotus leaves, have captured the attention of scientists and engineers over the past few decades. Recent trends have shifted from superhydrophobicity to superominipohobicity, or superamphiphobicity. In addition, dynamic rather than static surface wetting/dewetting properties, which can be triggered by various stimuli, including temperature, pH, magnetic/electric fields, solvents, light exposure etc, have been highly sought after for commercial applications. This book will focus on recent topics related to various stimuli-responsive wetting/dewetting surfaces, and give an overview of the knowledge and concepts of how to design and establish these smart artificial surfaces, which can be used for technical developments in a wide variety research fields.

Starting from the basic principles of wetting, electrowetting and fluid dynamics all the way up to those engineering aspects relevant for the development of specific devices, this is a comprehensive introduction and overview of the theoretical and practical aspects. Written by two of the most knowledgeable experts in the field, the text covers both current as well as possible future applications, providing basic working principles of lab-on-a-chip devices and such optofluidic devices as adaptive lenses and optical switches. Furthermore, novel e-paper display technology, energy harvesting and supercapacitors as well as electrowetting in the nano-world are discussed. Finally, the book contains a series of exercises and questions for use in courses on microfluidics or electrowetting. With its all-encompassing scope, this book will equally serve the growing community of students and academic and industrial researchers as both an introduction and a standard reference.

This book is an expanded form of the monograph, Dropwise Condensation on Inclined Textured Surfaces, Springer, 2013, published earlier by the authors, wherein a mathematical model for dropwise condensation of pure vapor over inclined textured surfaces was presented, followed by simulations and comparison with experiments. The model factored in several details of the overall

quasi-cyclic process but approximated those at the scale of individual drops. In the last five years, drop level dynamics over hydrophobic surfaces have been extensively studied. These results can now be incorporated in the dropwise condensation model. Dropwise condensation is an efficient route to heat transfer and is often encountered in major power generation applications. Drops are also formed during condensation in distillation devices that work with diverse fluids ranging from water to liquid metals. Design of such equipment requires careful understanding of the condensation cycle, starting from the birth of nuclei, followed by molecular clusters, direct growth of droplets, their coalescence, all the way to instability and fall-off of condensed drops. The model described here considers these individual steps of the condensation cycle. Additional discussions include drop shape determination under static conditions, a fundamental study of drop spreading in sessile and pendant configurations, and the details of the drop coalescence phenomena. These are subsequently incorporated in the condensation model and their consequences are examined. As the mathematical model is spread over multiple scales of length and time, a parallelization approach to simulation is presented. Special topics include three-phase contact line modeling, surface preparation techniques, fundamentals of evaporation and evaporation rates of a single liquid drop, and measurement of heat transfer coefficient during large-scale condensation of water vapor. We hope that this significantly expanded text meets the expectations of design engineers, analysts, and researchers working in areas related to phase-change phenomena and heat transfer.

Surface thermodynamics forms the foundation of any meaningful study of capillarity and wetting phenomena. The second edition of Applied Surface Thermodynamics offers a comprehensive state-of-the-art treatment of this critical topic. It provides students and researchers with fundamental knowledge and practical guidelines in solving real-world problems related to the measurement and interpretation of interfacial properties. Containing 40 percent new material and reorganized content, this second edition begins by presenting a generalized Gibbs theory of capillarity, including discussions of highly curved interfaces. Concentrating on drop-shape techniques, the book discusses liquid-fluid interfacial tension and its measurement. Next, the authors focus on contact angles with chapters on experimental procedures, thermodynamic models, and the interpretation of contact angles in terms of solid surface tension. The book discusses theoretical approaches to determining solid surface tension as well as interfacial tensions of particles and their manifestations. It concludes by discussing drop size dependence of contact angles and line tension. What's New in the Second Edition: Recent progress in Axisymmetric Drop Shape Analysis (ADSA) Image processing methods for drop shape analysis Advanced applications and generalizations of ADSA Recent studies of contact angle hysteresis Contact angles on inert fluoropolymers Update on line tension and the drop size dependence of contact angles Exploring a range of different aspects of

surface science and its applications, the book logically progresses so that knowledge of previous chapters enhances the understanding of subsequent material, yet each chapter is freestanding so that experienced researchers can quickly refer to topics of particular interest.

Life would not exist without sensitive, or soft, matter. All biological structures depend on it, including red blood globules, lung fluid, and membranes. So do industrial emulsions, gels, plastics, liquid crystals, and granular materials. What makes sensitive matter so fascinating is its inherent versatility. Shape-shifting at the slightest provocation, whether a change in composition or environment, it leads a fugitive existence. Physicist Michel Mitov brings drama to molecular gastronomy (as when two irreconcilable materials are mixed to achieve the miracle of mayonnaise) and offers answers to everyday questions, such as how does paint dry on canvas, why does shampoo foam better when you "repeat," and what allows for the controlled release of drugs? Along the way we meet a futurist cook, a scientist with a runaway imagination, and a penniless inventor named Goodyear who added sulfur to latex, quite possibly by accident, and created durable rubber. As Mitov demonstrates, even religious ritual is a lesson in the surprising science of sensitive matter. Thrice yearly, the reliquary of St. Januarius is carried down cobblestone streets from the Cathedral to the Church of St. Clare in Naples. If all goes as hoped--and since 1389 it often has--the dried blood contained in the reliquary's largest vial liquefies on reaching its destination, and Neapolitans are given a reaffirming symbol of renewal.

The words hydro, phobic and philic are derived from Greek and they mean water, fear and adoration respectively. These words are being used to define the interaction of water and other materials. As an example, these words are being used in classification of liquids and solids based on their solubility in water, as well as classification of solid surfaces regarding to their wettability. A lot of surfaces in the nature have Superhydrophobic and self-cleaning properties. For example the wings of a butterfly, leaves of some plants, including cabbage and Indian Cress, have the mentioned properties. The best example is the LOTUS leaf. This book collects new developments in the science of surface energy.

A comprehensive account of the physical foundations of collision and impact phenomena and their applications in a multitude of engineering disciplines. In-depth explanations are included to reveal the unifying features of collision phenomena in both liquids and solids, and to apply them to disciplines including theoretical and applied mechanics, physics and applied mathematics, materials science, aerospace, mechanical and chemical engineering, and terminal ballistics. Covering a range of examples from drops, jets, and sprays, to seaplanes and ballistic projectiles, and detailing a variety of theoretical, numerical, and experimental tools that can be used in developing new models and approaches, this is an ideal resource for students, researchers, and practicing engineers alike.

Motivated by a plethora of phenomena from nature, this textbook introduces into the physics of

wetting of surfaces. After a brief discussion of the foundations of surface tension, its implementation for floating objects, capillary waves, bouncing droplets, walking of water striders, etc. is discussed. Furthermore, Marangoni flows, surface tension inspired instabilities, condensation and evaporation of droplets, liquid marbles, superhydrophobicity and superoleophobicity (lotus effect) are introduced. All relevant concepts are illustrated by the numerous qualitative and quantitative exercises. Contents What is surface tension? Wetting of surfaces: the contact angle Surface tension-assisted floating of heavy and light objects and walking of water striders Capillary interactions between particles. Particles placed on liquid surfaces. Elasticity of liquid surfaces, covered by colloidal particles Capillary waves Oscillation of droplets Marangoni flow and surface instabilities Evaporation of droplets. The Kelvin and the coffee-stain effects Condensation, growth and coalescence of droplets and the breath-figure self-assembly Dynamics of wetting: bouncing, spreading and rolling of droplets (water hammer effect – water entry and drag-out problems)Superhydrophobicity and superoleophobicity: the Wenzel and Cassie wetting regimes The Leidenfrost effect. Liquid marbles: self-propulsion Physics, geometry, life and death of soap films and bubbles

Applied Colloid and Surface Chemistry is a broad introduction to this interdisciplinary field. Taking a genuinely applied approach, with applications drawn from a wide range of industries, this book will meet the demands of the student and professional currently working in the field. The text includes keynote sections written by practicing industrial research scientists, bringing to the reader a wealth of real industrial examples. These examples range from water treatment through to soil management as well as examples taken from the coatings and photographic industries. To aid accessibility, some of the more demanding mathematical derivations are separated from the main text, enabling them to be avoided as required. With carefully structured chapters, starting with learning objectives, and containing tutorial questions with answers and explanatory notes, this text is invaluable for undergraduates taking a first course on colloid and surface chemistry. This book will also be suitable to postgraduates and professionals, who need an up-to-date account of the subject.

Presents a comprehensive look at atmospheric corrosion, combining expertise in corrosion science and atmospheric chemistry Is an invaluable resource for corrosion scientists, corrosion engineers, and anyone interested in the theory and application of Atmospheric Corrosion Updates and expands topics covered to include, international exposure programs and the environmental effects of atmospheric corrosion Covers basic principles and theory of atmospheric corrosion chemistry as well as corrosion mechanisms in controlled and uncontrolled environments Details degradation of materials in architectural and structural applications, electronic devices, and cultural artifacts Includes appendices with data on specific materials, experimental techniques, atmospheric species

Droplet Wetting and Evaporation provides engineers, students, and researchers with the first comprehensive guide to the theory and applications of droplet wetting and evaporation. Beginning with a relevant theoretical background, the book moves on to consider specific aspects, including heat transfer, flow instabilities, and the drying of complex fluid droplets. Each chapter covers the principles of the subject, addressing corresponding practical issues and problems. The text is ideal for a broad range of domains, from aerospace and materials, to biomedical applications, comprehensively relaying the challenges and approaches from the different communities leading the way in droplet research and development. Provides a broad, cross-subject coverage of theory and application that is ideal for engineers, students and researchers who need to follow all major developments in this interdisciplinary field Includes comprehensive discussions of heat transfer, flow instabilities, and the drying of complex fluid droplets Begins with an accessible summary of fundamental theory before moving on to specific areas such as heat transfer, flow instabilities, and the drying of complex fluid droplets This is the third Volume in the series “Advances in Contact Angle, Wettability and Adhesion”

initiated to consolidate information and provide commentary on certain recent research aspects dealing with this important topic. Its predecessor Volumes 1 and 2 were published in 2013 and 2015, respectively. This new book comprising 15 research and review articles is divided into four parts: Part 1: Contact Angle Measurement and Analysis; Part 2: Wettability Behavior; Part 3: Hydrophobic/Superhydrophobic Surfaces; Part 4: Wettability, Surface Free Energy and Adhesion. The topics covered include: O Procedure to measure and analyse contact angles/drop shape behaviors. O Contact angle measurement considering spreading, evaporation and reactive substrate. O Measurement of contact angle of a liquid on a substrate of the same liquid. O Evolution of the axisymmetric droplet shape parameters. O Interfacial modulus of a solid surface. O Functionalization of textiles using UV-based techniques for surface modification—patterned wetting behavior. O Wettability behavior of oleophilic and oleophobic nanorough surfaces. O Wettability behavior of nanofluids. O Dielectrowetting for digital microfluidics. O Hydrophobicity and superhydrophobicity in fouling prevention. O Superhydrophobic/superhydrophilic hybrid surface. O Laser material processing for enhancing stem cell growth. O Wettability correlation for bioadhesion to different materials. O Determination of the surface free energy of solid surfaces: statistical consideration. O Determination of apparent surface free energy using hysteresis approach.

Written by 1991 Nobel laureate Pierre Gilles de Gennes, this fascinating book addresses topics ranging from soft-matter physics to the activities of science: the role of individual or team work, the relation of discovery to correction, and the interplay of conscience and knowledge. "Reading this book can be compared to strolling through a magnificent garden of fragile objects...I highly recommend it to any reader who is interested in condensed matter physics and science at large."-PHYSICS TODAY

The book presents a collection of practical applications of image processing and analysis. Different vision systems are more often used among others in the automotive industry, pharmacy, military and police equipment, automated production and measurement systems. In each of these fields of technology, digital image processing and analysis module is a critical part of the process of building this type of system. The majority of books in the market deal with theoretical issues. However, this unique publication specially highlights industrial applications, especially industrial measurement applications. Along with its wide spectrum of image processing and analysis applications, this book is an interesting reference for both students and professionals. Contents:Theoretical Introduction to Image Reconstruction and Processing:Data Set Preparation for k-NN Classifier Using the Measure of Representativeness (Marcin Raniszewski)Segmentation Methods in the Selected Industrial Computer Vision Application (Anna Fabijanska and Dominik Sankowski)Line Fractional-Order Difference/Sum, Its Properties and an Application in Image Processing (Piotr Ostalczyk)Computer Vision in Robotics:Management Software for Distributed Mobile Robot System (Maciej ?aski, Sylwester B?aszczyk, Piotr Duch, Rafa? Jachowicz, Adam Wulkiewicz, Dominik Sankowski and Piotr Ostalczyk)Advanced Vision Systems in Detection and Analysis of Characteristic Features of Objects (Adam Wulkiewicz, Rafa? Jachowicz, Sylwester B?aszczyk, Piotr Duch, Maciej ?aski, Dominik Sankowski and Piotr Ostalczyk)Pattern Recognition Algorithms for the Navigation of Mobile Platform (Rafa? Jachowicz, Sylwester B?aszczyk, Piotr Duch, Maciej ?aski, Adam Wulkiewicz, Dominik Sankowski and Piotr Ostalczyk)Partial Fractional-Order Difference in the Edge Detection (Piotr Duch, Rafa? Jachowicz, Sylwester B?aszczyk, Maciej ?aski, Adam Wulkiewicz, Piotr Ostalczyk and Dominik Sankowski)Application of Fractional-Order Derivative for Edge Detection in Mobile Robot System (Sylwester B?aszczyk, Rafa? Jachowicz, Piotr Duch, Maciej ?aski, Adam Wulkiewicz, Piotr Ostalczyk and Dominik Sankowski)Vision Based Human-Machine Interfaces: Visem Recognition (Krzysztof ?lot, Agnieszka Owczarek and Maria Janczyk)Industrial Applications of Computer Vision in Process Tomography, Material Science and Temperature Control:Hybrid Boundary Element Method Applied for Diffusion

Tomography Problems (Jan Sikora, Maciej Pa?czyk and Pawe? Wieleba)Two-phase Gas-Liquid Flow Structures and Phase Distribution Determination Based on 3D Electrical Capacitance Tomography Visualization (Robert Banasiak, Rados?aw Wajman, Tomasz Jaworski, Pawe? Fiderek, Jacek Nowakowski and Henryk Fidos)Tomographic Visualization of Dynamic Industrial Solid Transporting and Storage Systems (Zbigniew Chaniecki, Krzysztof Grudzie? and Andrzej Romanowski)Tomography Data Processing for Multiphase Industrial Process Monitoring (Krzysztof Grudzie?, Zbigniew Chaniecki, Andrzej Romanowski, Jacek Nowakowski and Dominik Sankowski)Dedicated 3D Image Processing Methods for the Analysis of X-Ray Tomography Data: Case Study of Materials Science (Laurent Babout and Marcin Janaszewski)Selected Algorithms of Quantitative Image Analysis for Measurements of Properties Characterizing Interfacial Interactions at High Temperatures (Krzysztof Strzecha, Anna Fabija?ska, Tomasz Koszmider and Dominik Sankowski)Theoretical Introduction to Image Reconstruction for Capacitance Process Tomography (Rados?aw Wajman, Krzysztof Grudzien, Robert Banasiak, Andrzej Romanowski, Zbigniew Chaniecki and Dominik Sankowski)Infra-Red Thermovision in Surface Temperature Control System (Jacek Kucharski, Tomasz Jaworski, Andrzej Fr?czyk and Piotr Urbanek)Medical and Other Applications of Computer Vision:The Computer Evaluation of Surface Color Changes in Cultivated Plants Influence by Different Environmental Factors (Joanna Sekulska-Nalewajko and Jaros?aw Goc?awski)Various Approaches to Processing and Analysis of Images Obtained from Immunoenzymatic Visualization of Secretory Activity with ELISPOT Method (Wojciech Bieniecki and Szymon Grabowski)Image Processing and Analysis Algorithms for Assessment and Diagnosis of Brain Diseases (Anna Fabijanska and Tomasz W?glinski)Computer Systems for Studying Dynamic Properties of Materials at High Temperatures (Marcin B?ka?a, Rafa? Wojciechowski and Dominik Sankowski) Readership: Researchers, professionals and academics in image analysis, machine perception/computer vision, software engineering and fuzzy logic. Keywords:Image Processing;Computer Vision;Robotics;Pattern Recognition;Fuzzy Logic;Process Tomography;Mobile Robots

This comprehensive handbook has become the definitive reference work in the field of nanoscience and nanotechnology, and this 4th edition incorporates a number of recent new developments. It integrates nanofabrication, nanomaterials, nanodevices, nanomechanics, nanotribology, materials science, and reliability engineering knowledge in just one volume. Furthermore, it discusses various nanostructures; micro/nanofabrication; micro/nanodevices and biomicro/nanodevices, as well as scanning probe microscopy; nanotribology and nanomechanics; molecularly thick films; industrial applications and nanodevice reliability; societal, environmental, health and safety issues; and nanotechnology education. In this new edition, written by an international team of over 140 distinguished experts and put together by an experienced editor with a comprehensive understanding of the field, almost all the chapters are either new or substantially revised and expanded, with new topics of interest added. It is an essential resource for anyone working in the rapidly evolving field of key technology, including mechanical and electrical engineers, materials scientists, physicists, and chemists.

Microdroplet technology has recently emerged to provide new and diverse applications via microfluidic functionality, especially in various areas of biology and chemistry. This book, then, gives an overview of the principle components and wide-ranging applications for state-of-the-art of droplet-based microfluidics. Chapter authors are internationally-leading researchers from chemistry, biology, physics and engineering that present various key aspects of micrdroplet technology -- fundamental flow physics, methodology and components for flow control, applications in biology and chemistry, and a discussion of future perspectives. This book acts as a reference for academics, post-graduate students, and researcher wishing to deepen their understand of

microfluidics and introduce optimal design and operation of new droplet-based microfluidic devices for more comprehensive analyte assessments.

The study of capillarity is in the midst of a veritable explosion. What is offered here is not a comprehensive review of the latest research but rather a compendium of principles designed for the undergraduate student and for readers interested in the physics underlying these phenomena.

This book provides a thorough overview of transport phenomena in complex fluids, based on the latest research results and the newest methods for their analytical prediction and numerical simulation. The respective chapters cover several topics, including: a description of the structural features of the most common complex fluids (polymer and surfactant solutions, colloidal suspensions); an introduction to the most common non-Newtonian constitutive models and their relationship with the fluid microstructure; a detailed overview of the experimental methods used to characterise the thermophysical properties, bulk rheology, and surface properties of complex fluids; a comprehensive introduction to heat, mass, and momentum transport, and to hydrodynamic instabilities in complex fluids; and an introduction to state-of-the-art numerical methods used to simulate complex fluid flows, with a focus on the Smoothed Particle Hydrodynamics (SPH) and the Dissipative Particle Dynamics (DPD) techniques. Subsequent chapters provide in-depth descriptions of phenomena such as thermal convection, elastic turbulence, mixing of complex fluids, thermophoresis, sedimentation, and non-Newtonian drops and sprays. The book addresses research scientists and professionals, engineers, R&D managers and graduate students in the fields of engineering, chemistry, biology, medicine, and the applied and fundamental sciences.

This book is a collection of papers presented at the “Forum Math-for-Industry 2015” for which the unifying theme was “The Role and Importance of Mathematics in Innovation”, held at the Institute of Mathematics for Industry, Kyushu University, October 26–30, 2015. The theme highlights two key roles that mathematics plays in supporting innovation in science, technology, and daily life, namely, needs-based and idea-based. For the former, mathematics assists with sorting through the possibilities and putting matters on a more rigorous foundation, and for the latter, mathematical models of the possible implementations play a key role. The book gives excellent examples of how mathematics assists with stimulating innovation and, thereby, highlights the importance and relevance of the concept Mathematics_FOR_Industry. The contents of this volume address productive and successful interaction between industry and mathematicians, as well as the cross-fertilization and collaboration that result when mathematics is involved with the advancement of science and technology.

The first stage of the physics of long, flexible chains was pioneered by eminent scientists such as Debye, Kuhn, Kramers, and Flory, who formulated the basic ideas. In recent years, because of the availability of new experimental and theoretical tools, a second stage of the physics of polymers has evolved. In this book, a noted physicist explains the radical changes that have taken place in this exciting and rapidly developing field. Pierre-Gilles de Gennes points out the three developments that have been essential for recent advances in the study of large-scale conformations and motions of flexible polymers in solutions and melts. They are the advent of neutron-scattering experiments on selectively deuterated molecules; the availability of inelastic

scattering of laser light, which allows us to study the cooperative motions of the chains; and the discovery of an important relationship between polymer statistics and critical phenomena, leading to many simple scaling laws. Until now, information relating to these advances has not been readily accessible to physical chemists and polymer scientists because of the difficulties in the new theoretical language that has come into use. Professor de Gennes bridges this gap by presenting scaling concepts in terms that will be understandable to students in chemistry and engineering as well as in physics.
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.
Capillarity and Wetting PhenomenaDrops, Bubbles, Pearls, WavesSpringer Science & Business Media
Winner of 2018 PROSE Award for MULTIVOLUME REFERENCE/SCIENCE This encyclopedia offers a comprehensive and easy reference to physical organic chemistry (POC) methodology and techniques. It puts POC, a classical and fundamental discipline of chemistry, into the context of modern and dynamic fields like biochemical processes, materials science, and molecular electronics. Covers basic terms and theories into organic reactions and mechanisms, molecular designs and syntheses, tools and experimental techniques, and applications and future directions Includes coverage of green chemistry and polymerization reactions Reviews different strategies for molecular design and synthesis of functional molecules Discusses computational methods, software packages, and more than 34 kinds of spectroscopies and techniques for studying structures and mechanisms Explores applications in areas from biology to materials science The Encyclopedia of Physical Organic Chemistry has won the 2018 PROSE Award for MULTIVOLUME REFERENCE/SCIENCE. The PROSE Awards recognize the best books, journals and digital content produced by professional and scholarly publishers. Submissions are reviewed by a panel of 18 judges that includes editors, academics, publishers and research librarians who evaluate each work for its contribution to professional and scholarly publishing. You can find out more at: proseawards.com Also available as an online edition for your library, for more details visit Wiley Online Library
On the liquid 's surface, the molecules have fewer neighbors in comparison with the bulk volume. As a result, the energy interaction shows itself in the surface tension. Traditionally, the surface tension can be assumed as a force in the unit of the length which can be counted by the unit of Newton on squared meter, or energy on the units of the surface. The surface tension, implies the interface between liquid and vapor, which is an example of the surface tensions. The equilibrium between these surface tensions, decides that a droplet on a solid surface, would have a droplet form or will change to layer form. This book collects new developments in wetting and wettability science.
An integral overview of the theory and design of printheads, authored by an expert with over 30 years' experience in the field of inkjet printing. Clearly structured, the book presents the design of a printhead in a comprehensive and

clear form, right from the start. To begin with, the working principle of piezo-driven drop-on-demand printheads in theory is discussed, building on the theory of mechanical vibrations and acoustics. Then the design of single-nozzle as well as multi-nozzle printheads is presented, including the importance of various parameters that need to be optimized, such as viscosity, surface tension and nozzle shape. Topics such as refilling the nozzle and the impact of the droplet on the surface are equally treated. The text concludes with a unique set of worked-out questions for training purposes as well as case studies and a look at what the future holds. An essential reference for beginning as well as experienced researchers, from ink developers to mechanical engineers, both in industry and academia.

Master simple to advanced biomaterials and structures with this essential text. Featuring topics ranging from bionanoengineered materials to bio-inspired structures for spacecraft and bio-inspired robots, and covering issues such as motility, sensing, control and morphology, this highly illustrated text walks the reader through key scientific and practical engineering principles, discussing properties, applications and design. Presenting case studies for the design of materials and structures at the nano, micro, meso and macro-scales, and written by some of the leading experts on the subject, this is the ideal introduction to this emerging field for students in engineering and science as well as researchers.

The book containing 18 chapters is divided into three parts: Part 1: Fundamentals of Ice Formation and Ice Characteristics; Part 2: Ice Adhesion and Its Measurement; and Part 3: Methods to Mitigate Ice Adhesion. The topics covered Include: Factors influencing the formation, adhesion and friction of ice; ice nucleation on solid surfaces; physics of ice nucleation and growth on a surface; condensation frosting; defrosting properties of structured surfaces; relationship between surface free energy and ice adhesion to surfaces; metrology of ice adhesion; test methods for quantifying ice adhesion strength to surfaces; interlaboratory studies of ice adhesion strength; mechanisms of surface icing and deicing technologies; anti-icing using microstructured surfaces; durability assessment of icephobic coatings; bio-inspired icephobic coatings; challenges in rational fabrication of icephobic surfaces; protection from ice accretion on aircraft; and numerical modeling and its application to inflight icing.

An accessible yet rigorous discussion, featuring case studies and study problems to illustrate and reinforce key concepts.

Many of the distinctive and useful phenomena of soft matter come from its interaction with interfaces. Examples are the peeling of a strip of adhesive tape, the coating of a surface, the curling of a fiber via capillary forces, or the collapse of a porous sponge. These interfacial phenomena are distinct from the intrinsic behavior of a soft material like a gel or a microemulsion. Yet many forms of interfacial phenomena can be understood via common principles valid for many forms of soft matter. Our goal in organizing this school was to give students a grasp of these common principles and their many ramifications and possibilities.

The Les Houches Summer School comprised over fifty 90-minute lectures over four weeks. Four four-lecture courses by Howard Stone, Michael Cates, David Nelson and L. Mahadevan served as an anchor for the program. A number of shorter courses and seminars rounded out the school. This volume collects the lecture notes of the school.

Proton exchange membrane (PEM) fuel cells show promise as CO2-free energy-conversion devices. Predictions show that reducing the size of the gas delivery channels could improve the efficiency and power density of PEM fuel cells, however the expected benefits of reduced channel sizes have not been realized due to flooding by water generated at the cathode. Channels with small dimensions exhibit an increased propensity toward flooding as surface tension forces become significant when compared with viscous, inertial, and pressure forces. This study characterizes the distinct two-phase flow profiles that result from the interplay of these forces. We investigate fundamental water-gas interactions in silicon channels of various hydraulic diameters and cross-sectional aspect ratios using a high-contrast fluorescent imaging technique. Then, we develop a test structure to study the evolution of two-phase flow structures in a microchannel geometry designed to mimic conditions in a fuel cell channel -- a 60-cm long channel with distributed water introduction through a porous gas diffusion layer (GDL) on one wall. Finally, we present considerations for the implementation of spinning-disk confocal microscopy to provide three-dimensional (3D) visualization of two-phase flow structures which may provide insight into key flow transitions that were observed during high-speed fluorescent flow visualization. By characterizing and modeling two-phase flow in various microchannel geometries and under a large range of flow conditions, these studies provide insight that enables the improved design of microchannels for two-phase flow in fuel cells and other practical devices.

Open microfluidics, the study of microflows having a boundary with surrounding air, encompasses different aspects such as paper or thread-based microfluidics, droplet microfluidics and open-channel microfluidics. Open-channel microflow is a flow at the micro-scale, guided by solid structures, and having at least a free boundary (with air or vapor) other than the advancing meniscus. This book is devoted to the study of open-channel microfluidics which (contrary to paper or thread or droplet microfluidics) is still very sparsely documented, but bears many new applications in biology, biotechnology, medicine, material and space sciences. Capillarity being the principal force triggering an open microflow, the principles of capillarity are first recalled. The onset of open-channel microflow is next analyzed and the fundamental notion of generalized Cassie angle (the apparent contact angle which accounts for the presence of air) is presented. The theory of the dynamics of open-channel microflows is then developed, using the notion of averaged friction length which accounts for the presence of air along the boundaries of the flow domain. Different channel morphologies are studied and geometrical features such as valves and capillary pumps are examined. An

introduction to two-phase open-channel microflows is also presented showing that immiscible plugs can be transported by an open-channel flow. Finally, a selection of interesting applications in the domains of space, materials, medicine and biology is presented, showing the potentialities of open-channel microfluidics.

The Frontiers in Materials Editorial Office team are delighted to present the inaugural “Women in Science: Materials” article collection, showcasing the high-quality work of women in science across the breadth of materials science and engineering. All researchers featured within this collection were individually nominated by the Topic Editors in recognition of their status as leading academics who have great potential to influence the future directions of their respective fields. The work presented here highlights the diversity of research performed across the entire breadth of the materials science and engineering field and presents advances in theory, experimentation, and methodology with applications for solving compelling problems. This Editorial features the corresponding author(s) of each paper published within this important collection, ordered by section alphabetically, highlighting them as the great researchers of the future. The Frontiers in Materials Editorial Office team would like to thank each researcher who contributed their work to this collection. We would also like to personally thank the Topic Editors for their exemplary leadership of this article collection; their strong support and passion for this important, community-driven collection has ensured its success and global impact. Emily Young Journal Development Manager

The revealing of the phenomenon of superhydrophobicity (the "lotus-effect") has stimulated an interest in wetting of real (rough and chemically heterogeneous) surfaces. In spite of the fact that wetting has been exposed to intensive research for more than 200 years, there still is a broad field open for theoretical and experimental research, including recently revealed superhydrophobic, superoleophobic and superhydrophilic surfaces, so-called liquid marbles, wetting transitions, etc. This book integrates all these aspects within a general framework of wetting of real surfaces, where physical and chemical heterogeneity is essential. Wetting of rough/heterogeneous surfaces is discussed through the use of the variational approach developed recently by the author. It allows natural and elegant grounding of main equations describing wetting of solid surfaces, i.e. Young, Wenzel and Cassie-Baxter equations. The problems of superhydrophobicity, wetting transitions and contact angle hysteresis are discussed in much detail, in view of novel models and new experimental data.

Offers an introduction to the topics in interfacial phenomena, colloid science or nanoscience. Designed as a pedagogical tool, this book recognizes the cross-disciplinary nature of the subject. It features descriptions of experiments and contains figures and illustrations that enhance the understanding of concepts.

Why does matter stick together? Why do gases condense to liquids, and liquids to solids? This book provides a detailed historical account of how some of the

leading scientists of the past three centuries have tried to answer these questions. The topic of cohesion and the study of intermolecular forces has been an important component of physical science research for hundreds of years. This book is organised into four broad periods of advances in our understanding. The first three are associated with Newton, Laplace and van der Waals. The final section gives an account of the successful use in the twentieth century of quantum mechanics and statistical mechanics to resolve most of the remaining problems. The book will be of primary interest to physical chemists and physicists, as well as historians of science interested in the historical origins of our modern day understanding of cohesion.

Offers a treatment of applied surface dynamics in relation to contact angles and surface tensions, providing a foundation for the subject and detailed presentations of recent techniques. The work supplies a theoretical framework for the study and measurement of surface tensions and contact angles, and acts as a day-to-day guide for laboratory pract

Nanodroplets, the basis of complex and advanced nanostructures such as quantum rings, quantum dots and quantum dot clusters for future electronic and optoelectronic materials and devices, have attracted the interdisciplinary interest of chemists, physicists and engineers. This book combines experimental and theoretical analyses of nanosized droplets which reveal many attractive properties. Coverage includes nanodroplet synthesis, structure, unique behaviors and their nanofabrication, including chapters on focused ion beam, atomic force microscopy, molecular beam epitaxy and the "vapor-liquid- solid" route. Particular emphasis is given to the behavior of metallic nanodroplets, water nanodroplets and nanodroplets in polymer and metamaterial nanocomposites. The contributions of leading scientists and their research groups will provide readers with deeper insight into the chemical and physical mechanisms, properties, and potential applications of various nanodroplets.

Bioinspired Design of Materials Surfaces reviews novel methods and technologies used to design surfaces and materials for smart material and device applications. The author discusses how materials wettability can be impacted by the fabrication of micro- and nanostructures, anisotropic structures, gradient structures, and heterogeneous patterned structures on the surfaces of materials. The design of these structures was inspired by nature, including lotus, cactus, beetle back and butterfly wings, spider silk, and shells. The author reviews the various wettability functions that can result from these designs, such as self-cleaning, directional adhesion, droplet driving, anti-adhesion, non-wetting, liquid repellent properties, liquid separation, liquid splitting, and more. This book presents a key reference on how to fabricate bioinspired structures on materials for desired functions of materials wettability. It also discusses challenges, opportunities and many potential applications, such as oil-water separation devices, water harvesting devices and photonic device applications. Introduces the fundamentals of both bioinspired materials design and the theory behind

dynamic materials wettability Reviews the latest methods and technologies used to create functional surfaces and structured materials that impact and potentially control wettability Provides a snapshot of potential device applications, such as oil-water separation, water harvesting, fluid transport, photonic applications, and much more

Keeping pace with explosive developments in the field, Colloidal Science of Flotation reviews and updates the fundamentals of the bubble-particle collection phenomenon using a self-consistent approach that helps readers understand the hydrodynamic aspects of bubble-particle collection. The authors examine bubble rise velocity, water velocity around air bubbles, the thinning of intervening liquid films, the stability of particle-bubble aggregates, and macroscopic processes in froth. They also survey the applicability of emerging technologies in industrial flotation deinking, wastewater treatment, flotation of plastics, and improvements in minerals and coal flotation.