Statistical Thermodynamics Of Surfaces Interfaces And Membranes Frontiers In Physics

"Thermodynamics of Materials" introduces the basic underlying principles of thermodynamics as well as their applicability to the behavior of all classes of materials, while providing an integrated approach from macro- (or classical) thermodynamics to meso- and nanothermodynamics, and microscopic (or statistical) thermodynamics. The book is intended for scientists, engineers and graduate students in all fields involving materials science-related disciplines. Both Dr. Qing Jiang and Dr. Zi Wen are professors at Jilin University.

This volume presents computer simulation methods and mathematical modelling of physical processes used in surface science research. It offers in-depth analysis of advanced theoretical approaches to behaviours of fluids in contact with porous, semiporous and nonporous solid surfaces. The book also explores interfacial systems for a wide variety of p

This graduate-level textbook covers the major developments in surface sciences of recent decades, from experimental tricks and basic techniques to the latest experimental methods and theoretical understanding. It is unique in its attempt to treat the physics of surfaces, thin films and interfaces, surface chemistry, thermodynamics, statistical physics and the physics of the solid/electrolyte interface in an integral manner, rather than in separate compartments. It is designed as a handbook for the researcher as well as a study-text for graduate students. Written explanations are supported by 350 graphs and illustrations.

Part of the IUPAC Series on Analytical and Physical Chemistry of Environmental Systems, this book collects and integrates current knowledge of the chemical mechanisms, kinetics, transport and interactions involved in processes at biological interfaces in environmental systems. Provides important, current knowledge for environmental scientists and related fields Highlights key directions for future research Follows on from a previous title in the series, Metal Speciation and Bioavailability in Aquatic Systems Written by internationally renowned editors and authors Kinetics and Transport at Biointerfaces will be a valuable resource for researchers and students interested in understanding the fundamentals of chemical kinetics and transport processes in bioenvironmental systems. The content is required reading for chemists, physicists and biologists in environmentally oriented disciplines.

The fact that the surfaces of real solids are geometrically distorted and chemically non-uniform has long been realized by the scientists investigating various phenomena occurring on solid surfaces. Even in the case when diffraction experiments show a well-organized bulk solid structure, the surface atoms or molecules will usually exhibit a much smaller degree of surface organization. In addition to the results obtained from electron diffraction, this can be seen in the impressive images obtained from STM and AFM microscopies. This geometric and chemical disorder is the source of the energetic heterogeneity for molecules adsorbing on real solid surfaces. Hundreds of papers have been published showing that this heterogeneity is a major factor in determining the behaviour of real adsorption systems. Studies of adsorption on energetically heterogeneous surfaces have proceeded along three somewhat separate paths, with only minor coupling of ideas. One was the study of adsorption equilibria on heterogeneous solid surfaces. The second path was the study of time evolution of adsorption processes such as surface diffusion or adsorption-desorption kinetics on heterogeneous surfaces, and the third was the study of adsorption in porous solids, or more generally, adsorption in systems with limited dimensions. The present monograph is a first attempt to provide a synthesis of the ways that surface geometric and energetic heterogeneities affect both the equilibria and the time evolution of adsorption on real solids.

The book contains 17 chapters written by a team of internationally recognized specialists, some of whom have already published books on adsorption.

This textbook concentrates on modern topics in statistical physics with an emphasis on strongly interacting condensed matter systems. The book is self-contained and is suitable for beginning graduate students in physics and materials science or undergraduates who have taken an introductory course in statistical mechanics. Phase transitions and critical phenomena are discussed in detail including mean field and Landau theories and the renormalization group approach. The theories are applied to a number of interesting systems such as magnets, liquid crystals, polymers, membranes, interacting Bose and Fermi fluids; disordered systems, percolation and spin of equilibrium concepts are also discussed. Computer simulations of condensed matter systems by Monte Carlo-based and molecular dynamics methods are treated.

Master the principles of thermodynamics with this comprehensive undergraduate textbook, carefully developed to provide students of chemical engineering and chemistry with a deep and intuitive understanding of the practical applications of these fundamental ideas and principles. Logical and lucid explanations introduce core thermodynamic concepts in the context of their measurement and experimental origin, giving students a thorough understanding of how theoretical concepts apply to practical situations. A broad range of real-world applications relate key topics to contemporary issues, such as energy efficiency, environmental engineering and climate change, and further reinforce students' understanding of the core material. This is a carefully organized, highly pedagogical treatment, including over 500 open-ended study questions for discussion, over 150 varied homework problems, clear and objective standards for measuring student progress, and a password-protected solution manual for instructors.

Advances in Planar Lipid Bilayers and Liposomes, Volume 11, includes invited chapters on a broad range of topics, covering both of the main arrangements of the reconstituted system, namely planar lipid bilayers and spherical liposomes. The invited authors present the latest results of their own research groups in this exciting multidisciplinary field. This volume addresses the broader goal with both systems, planar lipid bilayers and spherical liposomes, which is the further development of this interdisciplinary field worldwide. Incorporates contributions from newcomers and established and experienced researchers Explores the planar lipid bilayer systems and spherical liposomes from both theoretical and experimental perspectives Serves as an indispensable source of information for new scientists

Published under the auspices of both IUPAC and its affiliated body, the International Association of Chemical Thermodynamics (IACT), this book will serve as a guide to scientists or technicians who use equations of state for fluids. Concentrating on the application of theory, the practical use of each type of equation is discussed and the strengths and weaknesses of each are addressed. It includes material on the equations of state for chemically reacting and non-equilibrium fluids which have undergone significant developments and brings up to date the equations of state for fluids and fluid mixtures. Applied Thermodynamics of Fluids addresses the needs of practitioners within academia, government and industry by assembling an international team of distinguished experts to provide each chapter. The topics presented in the book are important to the energy business, particularly the hydrocarbon economy and the development of new power sources and are also significant for the application of liquid crystals and ionic liquids to commercial products. This reference will be useful for post graduate researchers in the fields of chemical engineering, mechanical engineering, chemistry and physics.

Physics of Polymer Surfaces and Interfaces emphasizes current theoretical ideas and modern experimental tools for characterizing the physical properties of polymer surfaces and interfaces. Foremost are their important roles in polymer technology throughthe processes of wetting, adhesion, adsorption, and through their effect on the kinetics of phase separation and mechanical mixing of molten polymers. Each

of the 14 chapters in this book stands as a 'mini-review' of a specific subject. This up-to-date compendium of the most significant theoretical and experimental works provides a scientific understanding of the physics of polymer interfaces and surfaces and will aid scientists in planning and interpreting new results.

For many processes and applications in science and technology a basic knowledge of liquids and solutions is a must. Gaining a better understanding of the behavior and properties of pure liquids and solutions will help to improve many processes and to advance research in many different areas. This book provides a comprehensive, self-contained and integrated survey of this topic and is a must-have for many chemists, chemical engineers and material scientists, ranging from newcomers in the field to more experienced researchers. The author offers a clear, well-structured didactic approach and provides an overview of the most important types of liquids and solutions. Special topics include chemical reactions, surfaces and phase transitions. Suitable both for introductory as well as intermediate level as more advanced parts are clearly marked. Includes also problems and solutions.

Any notion that surface science is all about semiconductors and coatings is laid to rest by this encyclopedic publication: Bioengineered interfaces in medicine, interstellar dust, DNA computation, conducting polymers, the surfaces of atomic nuclei - all are brought up to date. Frontiers in Surface and Interface Science - a milestone publication deserving a wide readership. It combines a sweeping expert survey of research today with an educated look into the future. It is a future that embraces surface phenomena on scales from the subatomic to the galactic, as well as traditional topics like semiconductor design, catalysis, and surface processing, modeling and characterization. And, great efforts have been made to express sophisticated ideas in an attractive and accessible way. Nanotechnology, surfaces for DNA computation, polymer-based electronics, soft surfaces, interstellar surface chemistry - all feature in this comprehensive collection.

Surface Physics of Materials presents accounts of the physical properties of solid surfaces. The book contains selected articles that deal with research emphasizing surface properties rather than experimental techniques in the field of surface physics. Topics discussed include transport of matter at surfaces; interaction of atoms and molecules with surfaces; chemical analysis of surfaces; and adhesion and friction. Research workers, teachers and graduate students in surface physics, and materials scientist will find the book highly useful.

This invaluable book explores the delicate interplay between geometry and statistical mechanics in materials such as microemulsions, wetting and growth interfaces, bulk lyotropic liquid crystals, chalcogenide glasses and sheet polymers, using tools from the fields of polymer physics, differential geometry, field theory and critical phenomena. Several chapters have been updated relative to the classic 1989 edition. Morever, there are now three entirely new chapters -- on effects of anisotropy and heterogeneity, on fixed connectivity membranes and on triangulated surface models of fluctuating membranes.

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Mechanics of Self-Avoiding Crumpled Manifolds (B Duplantier)Anisotropic and Heterogeneous Polymerized Membranes (L Radzihovsky)Fixed-Connectivity Membranes (M J Bowick)Triangulated-Surface Models of Fluctuating Membranes (G Gompper & D M Kroll) Readership: Condensed matter physicists, biophysicists, polymer scientists and statistical mechanicians. Keywords:Reviews:“The additional chapters added for the second edition highlight some of the new results (consequences of anisotropy), and place the older contributions in better perspective (renormalizability, connections to triangulated surfaces). The revised edition will serve as an even better introduction to this interesting topic at the intersection of geometry, field theory, and polymer physics.”Mehran Kardar Professor of Physics MIT “This is the book I used to get introduced into the field of the statistical mechanics of membranes and surfaces. I still use it and recommend it to my students and to anyone who is interested in this very exciting field. The different chapters describe detailed and clear mathematical developments, experimental presentations and high quality numerical work presented with superb clarity. This book, with its newest updated second edition, will remain as a reference textbook for many years to come.”Alex Travesset Iowa State University and Ames Laboratory “The first edition set the field of geometry and statistical mechanics in motion. This update, with added material, will be as important to researchers in this now burgeoning field as the original edition. The collection strikes an excellent balance between pedagogical review and current results and developments. This book should be on every theorist's shelf.”Professor Randall D Kamien University of Pennsylvania '

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.

A practical guide for graduate students and researchers on all aspects of x-ray scattering experiments on liquid surfaces and interfaces.

This edited volume offers complete coverage of the latest theoretical, experimental, and computer-based data as summarized by leading international researchers. It promotes full understanding of the physical phenomena and mechanisms at work in surface and interfacial tensions and gradients, their direct impact on interface shape and movement, and t

In Thermal Physics: Thermodynamics and Statistical Mechanics for Scientists and Engineers, the fundamental laws of thermodynamics are stated precisely as postulates and subsequently connected to historical context and developed mathematically. These laws are applied systematically to topics such as phase equilibria, chemical reactions, external forces, fluid-fluid surfaces and interfaces, and anisotropic crystal-fluid interfaces. Statistical mechanics is presented in the context of information theory to quantify entropy, followed by development of the most important ensembles: microcanonical, canonical, and grand canonical. A unified treatment of ideal classical, Fermi, and Bose gases is presented, including Bose condensation, degenerate Fermi gases, and classical gases with internal structure. Additional topics include paramagnetism, adsorption on dilute

sites, point defects in crystals, thermal aspects of intrinsic and extrinsic semiconductors, density matrix formalism, the Ising model, and an introduction to Monte Carlo simulation. Throughout the book, problems are posed and solved to illustrate specific results and problem-solving techniques. Includes applications of interest to physicists, physical chemists, and materials scientists, as well as materials, chemical, and mechanical engineers Suitable as a textbook for advanced undergraduates, graduate students, and practicing researchers Develops content systematically with increasing order of complexity Self-contained, including nine appendices to handle necessary background and technical details

Since the publication of the second edition of this book in 2004, gene therapy and cell therapy clinical trials have yielded some remarkable successes and some disappointing failures. Now in its third edition, Gene and Cell Therapy: Therapeutic Mechanisms and Strategies assembles many of the new technical advances in gene delivery, clinical applications, and new approaches to the regulation and modification of gene expression. New Topics Covered in this Edition: Gene and Cell Therapies for Diabetes and Cardiovascular Diseases Clinical Trials Human Embryonic Stem Cells Tissue Engineering Combined with Cell Therapies Novel Polymers Relevant Nanotechnologies SiRNA Therapeutic Strategies Dendrimer Technologies Comprised of contributions from international experts, this book begins with a discussion of delivery systems and therapeutic strategies, exploring retroviral vectors and adenovirus vectors, as well as other therapeutic strategies. The middle section focuses on gene expression and detection, followed by an examination of various therapeutic strategies for individual diseases, including hematopoietic disorders, cardiovascular conditions, cancer, diabetes, cystic fibrosis, neurological disorders, and childhood-onset blindness. The final section discusses recent clinical trials and regulatory issues surrounding the new technology. This compendium is assembled by noted molecular biologist and biochemist Nancy Smyth Templeton. Baylor College of Medicine and several other institutions have used Dr. Templeton’s non-viral therapeutics in clinical trials for the treatment of lung, breast, head and neck, and pancreatic cancers, as well as Hepatitis B and C. She continues to work at the forefront of research in gene and cell therapies. Her contributions, as well as those contained in this volume, are sure to advance the state of the art of these revolutionary life-saving technologies.

Metallurgical Thermodynamics, as well as its modified version, Thermodynamics of Materials, forms a core course in metallurgical and materials engineering, constituting one of the principal foundations in these disciplines. Designed as an undergraduate textbook, this concise and systematically organized text deals primarily with the thermodynamics of systems involving physico-chemical processes and chemical reactions, such as calculations of enthalpy, entropy and free energy changes of processes; thermodynamic properties of solutions; chemical and phase equilibria; and thermodynamics of surfaces, interfaces and defects. The major emphasis is on high-temperature systems and processes involving metals and inorganic compounds. The many worked examples, diagrams, and tables that illustrate the concepts discussed, and chapter-end problems that stimulate self-study should enable the students to study the subject with enhanced interest.

Volume V is the counterpart of Volume IV and treats hydrophilic colloids and related items. Contains edited contributions on steric

stabilization, depletion, polyelectrolytes, proteins at interfaces, association colloids, microemulsions, thin films, foams and emulsions. J. Lyklema is coauthor of two chapters and general editor. Other authors include: G.J. Fleer, F.A.M. Leermakers, M.A. Cohen Stuart, W. Norde, J.A.G. Buijs, J.C. Eriksson, T.Sottmann, R. Strey, D. Platikanov, D. Ekserova, V.Bergeron and P.Walstra. * This volume completes the prestigious series Fundamentals of Interface and Colloid Science * Together with Volume IV this book provides a comprehensive introduction to colloid science. * Explains and elaborates phenomena starting from basic principles and progresses to more advanced topics

This book provides a comprehensive exposition of the theory of equilibrium thermodynamics and statistical mechanics at a level suitable for well-prepared undergraduate students. The fundamental message of the book is that all results in equilibrium thermodynamics and statistical mechanics follow from a single unprovable axiom — namely, the principle of equal a priori probabilities — combined with elementary probability theory, elementary classical mechanics, and elementary quantum mechanics.

Statistical mechanics is a branch of theoretical physics and chemistry that studies, using probability theory, the average behavior of a mechanical system where the state of the system is uncertain. A common use of statistical mechanics is in explaining the thermodynamic behavior of large systems. Microscopic mechanical laws do not contain concepts such as temperature, heat, or entropy, however, statistical mechanics shows how these concepts arise from the natural uncertainty that arises about the state of a system when that system is prepared in practice. The benefit of using statistical mechanics is that it provides exact methods to connect thermodynamic quantities to microscopic behavior, whereas in classical thermodynamics the only available option would be to just measure and tabulate such quantities for various materials. This book contains ten chaters. First chapter presents Maxwellian view of thermodynamics and statistical mechanics. In second chapter, we discuss the important relations between thermodynamics and statistical mechanics in extensive and nonextensive systems through two different approaches and revealed the inherent correlations between thermodynamics and statistical physics. In third chapter, we review the continuum, statistical thermodynamics of surfaces and interfaces in soft matter where both the energy and entropy of the surface are comparable. The problem of correlation between the temperature of the target surface and the mass-spectrometer signal in LV-MS has been theoretically analyzed in fourth chapter. The objective of fifth chapter is to make a connection between macro-parameters and meso-cracks using the models of statistical mechanics and thermodynamics. The goal of sixth chapter is to propose a self-consistent stochastic thermodynamics, non-equilibrium thermodynamics are respected in the appropriate limit. Seventh chapter focuses on sate-of-the-art first-principles-based theoretical methodology and concepts which are valuable for obtaining a greater understanding and prediction of surface processes and phase transitions at the atomic level. Eighth chapter describes statistical mechanical proof of the second law of thermodynamics based on volume entropy. The aim of the ninth chapter is to show a new approach to modeling SMAs based on the block-spin-appraoch and renormalization in statistical mechanics. Nonequilibrium statistical mechanics of systems with long-range interactions have been described in last chapter.

Computational Materials Science provides the theoretical basis necessary for understanding atomic surface phenomena

and processes of phase transitions, especially crystallization, is given. The most important information concerning computer simulation by different methods and simulation techniques for modeling of physical systems is also presented. A number of results are discussed regarding modern studies of surface processes during crystallization. There is sufficiently full information on experiments, theory, and simulations concerning the surface roughening transition, kinetic roughening, nucleation kinetics, stability of crystal shapes, thin film formation, imperfect structure of small crystals, size dependent growth velocity, distribution coefficient at growth from alloy melts, superstructure ordering in the intermetallic compound. Computational experiments described in the last chapter allow visualization of the course of many processes and better understanding of many key problems in Materials Science. There is a set of practical steps concerning computational procedures presented. Open access to executable files in the book make it possible for everyone to understand better phenomena and processes described in the book. Valuable reference book, but also helpful as a supplement to courses Computer programs available to supplement examples Presents several new methods of computational materials science and clearly summarizes previous methods and results

This invaluable book explores the delicate interplay between geometry and statistical mechanics in materials such as microemulsions, wetting and growth interfaces, bulk lyotropic liquid crystals, chalcogenide glasses and sheet polymers, using tools from the fields of polymer physics, differential geometry, field theory and critical phenomena. Several chapters have been updated relative to the classic 1989 edition. Moreover, there are now three entirely new chapters on effects of anisotropy and heterogeneity, on fixed connectivity membranes and on triangulated surface models of fluctuating me.

The COSMO-RS technique is a novel method for predicting the thermodynamic properties of pure and mixed fluids which are important in many areas, ranging from chemical engineering to drug design. COSMO-RS, From Quantum Chemistry to Fluid Phase Thermodynamics and Drug Design is about this novel technology, which has recently proven to be the most reliable and efficient tool for the prediction of vapour-liquid equilibria. In contrast to group contribution methods, which depend on an extremely large number of experimental data, COSMO-RS calculates the thermodynamic data from molecular surface polarity distributions, resulting from quantum chemical calculations of the individual compounds in the mixture. In this book, the author cleverly combines a vivid overview of the partly demanding theoretical steps with a deeper analysis of their scientific background and justification. Aimed at theoretical chemists, computational chemists, physical chemists, chemical engineers, thermodynamicists as well as students,academic and industrial experts, COSMO-RS, From Quantum Chemistry to Fluid Phase Thermodynamics and Drug Design provides a novel viewpoint to anyone looking to gain more insight into the theory and potential of the unique method, COSMO-RS. The only book currently available on COSMO-RS technique Provides a novel viewpoint for the scientific understanding and for the practical

quantitative treatment of fluid phase thermodynamics Includes illustrative examples of the COSMOtherm program

In eight volumes, Surface and Interface Science covers all fundamental aspects and offers a comprehensive overview of this research area for scientists working in the field, as well as an introduction for newcomers. Volume 5: Solid-Gas Interfaces I Topics covered: Basics of Adsorption and Desorption Surface Microcalorimetry Adsorption of Rare Gases Adsorption of Alkali and Other Electro-Positive Metals Halogen adsorption on metals Adsorption of Hydrogen Adsorption of Water Adsorption of (Small) Molecules on Metal Surfaces Surface Science Approach to Catalysis Adsorption, Bonding and Reactivity of Unsaturated and Multifunctional Molecules Volume 6: Solid-Gas Interfaces II Topics covered: Adsorption of Large Organic Molecules Chirality of Adsorbates Adsorption on Semiconductor Surfaces Adsorption on Oxide Surfaces Oscillatory Surface Reactions Statistical Surface Thermodynamics Theory of the Dynamics at Surfaces Atomic and Molecular Manipulation

This comprehensivereference/text provides a thorough grounding in the fundamentals of rotating machinery vibration-treating computer model building, sources and types of vibration, and machine vibration signal analysis. Illustrating turbomachinery, vibration severity levels, condition monitoring, and rotor vibration cause identification, Ro

Understanding the structural and thermodynamic properties of surfaces, interfaces, and membranes is important for both fundamental and practical reasons. Important applications include coatings, dispersants, encapsulating agents, and biological materials. Soft materials, important in the development of new materials and the basis of many biological systems, cannot be designed using trial and error methods due to the multiplicity of components and parameters. While these systems can sometimes be analyzed in terms of microscopic mixtures, it is often conceptually simpler to regard them as dispersions and to focus on the properties of the internal interfaces found in these systems. The basic physics centers on the properties of quasi-two-dimensional systems embedded in the three-dimensional world, thus exhibiting phenomena that do not exist in bulk materials. This approach is the basis behind the theoretical presentation of Statistical Thermodynamics of Surfaces, Interfaces, and Membranes. The approach adapted allows one to treat the rich diversity of phenomena investigated in the field of soft matter physics (including both colloid/interface science as well as the materials and macromolecular aspects of biological physics) such as interfacial tension, the roughening transition, wetting, interactions between surfaces, membrane elasticity, and self-assembly. Presented as a set of lecture notes, this book is aimed at physicists, physical chemists, biological physicists, chemical engineers, and materials scientists who are interested in the statistical mechanics that underlie the macroscopic, thermodynamic properties of surfaces, interfaces, and membranes. This paperback edition contains all the material published in the original hard-cover edition as well as additional clarifications and explanations.

A self-contained, mathematical introduction to the driving ideas in equilibrium statistical mechanics, studying important models in detail.

As a result of their unique physical properties, biological membrane mimetics, such as liposomes, are used in a broad range of scientific and technological applications. Liposomes, Lipid Bilayers and Model Membranes: From Basic Research to Application describes state-of-the-art research and future directions in the field of membranes, which has evolved from basic studies of the physicochemical properties of amphiphiles to their application in industry and medicine. Written by leading researchers in their fields, this book describes basic and applied research, and serves as a useful reference for both the novice and the expert. Part one covers a range of basic research topics, from theory and computational simulations to some of the most up-to-date experimental research. Topics discussed include soft matter physics of membranes, nonlamellar phases, extraction of molecules by amphiphiles, lipid models for membrane rafts, membrane dynamics, nanodiscs, microemulsions, active membranes, as well as interactions of bilayers with drugs or DNA to treat disease or for gene transfer, respectively. Part two of the book focuses on technological applications of amphiphiles, such as liposome-based nanoparticles for drug delivery, formulation of liposomes for prolonged in vivo circulation and functionalization for medical purposes, novel drug delivery systems for increased drug loading, and the use of tethered membranes for bio-sensing applications. Chapters also describe the use of liposomes in textile dyeing and how lipidic nanoparticles are used by the food industry.

Computational Statistical Mechanics describes the use of fast computers to simulate the equilibrium and nonequilibrium properties of gases, liquids, and solids at, and away from equilibrium. The underlying theory is developed from basic principles and illustrated by applying it to the simplest possible examples. Thermodynamics, based on the ideal gas thermometer, is related to Gibb's statistical mechanics through the use of Nosé-Hoover heat reservoirs. These reservoirs use integral feedback to control temperature. The same approach is carried through to the simulation and analysis of nonequilibrium mass, momentum, and energy flows. Such a unified approach makes possible consistent mechanical definitions of temperature, stress, and heat flux which lead to a microscopic demonstration of the Second Law of Thermodynamics directly from mechanics. The intimate connection linking Lyapunov-unstable microscopic motions to macroscopic dissipative flows through multifractal phase-space structures is illustrated with many examples from the recent literature. The book is well-suited for undergraduate courses in advanced thermodynamics, statistical mechanic and transport theory, and graduate courses in physics and chemistry.

A collection of papers from the International Symposium on Complex and Supermolecular Fluids presents tutorials and minireviews focusing on the physical properties of complex fluids using the concepts and techniques of condensed matter physics. Stresses the unifying principles, rather than chemical details, behind the physics of diverse materials. Principal topics include colloids, microemulsions, ferrofluids, and micellar systems. Characterizes supermolecular and complex fluids by exploiting their

analogies to atomic systems. Papers organized by physical phenomena and not by material.

Ion Correlations at Electrified Soft Matter Interfaces presents an investigation that combines experiments, theory, and computer simulations to demonstrate that the interdependency between ion correlations and other ion interactions in solution can explain the distribution of ions near an electrified liquid/liquid interface. The properties of this interface are exploited to vary the coupling strength of ion-ion correlations from weak to strong while monitoring their influence on ion distributions at the nanometer scale with X-ray reflectivity and on the macroscopic scale with interfacial tension measurements. This thesis demonstrates that a parameter-free density functional theory that includes ion-ion correlations and ion-solvent interactions is in agreement with the data over the entire range of experimentally tunable correlation coupling strengths. The reported findings represent a significant advance towards understanding the nature and role of ion correlations in charged soft-matter. Ion distributions underlie many scientific phenomena and technological applications, including electrostatic interactions between charged biomolecules and the efficiency of energy storage devices. These distributions are determined by interactions dictated by the chemical properties of the ions and their environment, as well as the long-range nature of the electrostatic force. The presence of strong correlations between ions is responsible for counterintuitive effects such as like-charge attraction.

Presents a multi-disciplinary perspective on the physics of life and the particular role played by lipids and the lipid-bilayer component of cell membranes. Emphasizes the physical properties of lipid membranes seen as soft and molecularly structured interfaces. By combining and synthesizing insights obtained from a variety of recent studies, an attempt is made to clarify what membrane structure is and how it can be quantitatively described. Shows how biological function mediated by membranes is controlled by lipid membrane structure and organization on length scales ranging from the size of the individual molecule, across molecular assemblies of proteins and lipid domains in the range of nanometers, to the size of whole cells. Applications of lipids in nano-technology and biomedicine are also described.