

# Microscale Surface Tension and its Applications

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**Keywords:** contact angle; droplets; liquid bridge; microfabrication; micromanipulation; pick-and-place; soft robotics; surface tension; wetting

More than 200 years since the earliest scientific investigations by Young, Laplace and Plateau, liquid surface tension is still the object of thriving fundamental and applied research. Partly inspired by nature's evolutionary designs exploiting physical properties inherent to liquids, this research is enabling a rich and ever expanding set of technological applications. *Micromachines*' Special Issue on "Microscale Surface Tension and its Applications" was therefore conceived to present fundamental knowledge, showcase relevant ongoing works and highlight prospective research directions regarding capillarity, wetting, and collateral topics.

Building on significant advances in miniaturization and soft matter, as well as in metrology and interfacial engineering, surface tension effects are indeed a major key to current developments in soft and fluidic microrobotics, precision micromanipulation and fluid/solid interactions. Benefiting from scaling laws, surface tension and capillary effects are expected to enable and support sensing, actuation, adhesion, confinement, compliance, and other structural and functional properties necessary in micro- and nanosystems.

This Special Issue successfully gathered novel and multidisciplinary contributions on capillary micromechatronics (capillary grippers, vibration-induced transport of droplets, capillary actuators, self-alignment), superhydrophobic and self-lubricating surfaces, solute-capillary Marangoni-based micromixing, and droplets micromanipulation. Worth highlighting are also two reviews on interfacial tension measurement and self-cleaning surfaces.

This varied and stimulating ensemble of contributions echoes many of the interests and directions identified during the 1st International Conference on Multiscale Applications of Surface Tension (microMAST 2016), organized in September 2016 by the Belgian thematic network on Microfluidics and Micromanipulation ([www.micromast2016.be](http://www.micromast2016.be)). The goal of that conference and network was, and remains, to bring together various, interrelated or complementary research communities to collectively address up-to-date and unsolved questions concerning the broad field of surface tension effects.

In recapitulating the spirit of that ongoing enterprise, we hope that the interplay between fundamental questions and relevant applications driven by the downscaling of capillary effects captured in this Special Issue will provide an inspiring point of view for the readership of *Micromachines*.

# Surface Science And Its Applications

**Victor E. Henrich, P. A. Cox**



## **Surface Science And Its Applications:**

Surface Science R.J. MacDonald, Edmund C. Taglauer, Klaus Wandelt, 2012-12-06 Modern technologies increasingly rely on low dimensional physics at interfaces and in thin films and nano structures Surface science holds a key position in providing the experimental methods and theoretical models for a basic understanding of these effects This book includes case studies and status reports about research topics such as surface structure determination by tensor LEED and surface X ray diffraction the preparation and detection of low dimensional electronic surface states quantitative surface compositional analysis the dynamics of adsorption and reaction of adsorbates e g kinetic oscillations the characterization and control of thin film and multilayer growth including the influence of surfactants a critical assessment of the surface physics approach to heterogeneous catalysis

**Surface Science** Russell Howe, Robert N. Lamb, Klaus Wandelt, 1993-01-01 This proceedings volume brings together new techniques and experiments in fundamental surface science to problems of metal and semiconductor surfaces thin films and catalysts It contains the invited lectures from an Australian German Surface Science Workshop held in Sydney Australia The intention of this volume is to illustrate the wide scope of modern surface science The central theme of the book is the application of surface science to problems of practical significance It will attract interest as a teaching aid for graduate students and academic researchers The emphasis on application will also appeal to industrial scientists seeking to learn how surface science techniques can be applied to real world problems

**Surface Science and Advanced Functional Applications of Cellulose Composites** Ming-Guo Ma, Xing-Xiang Ji, 2024-11-16 Surface Science and Advanced Functional Applications of Cellulose Composites Volume 38 looks at cellulose composites in relation to surface science and applications The book provides a comprehensive summary grounded in the surface chemistry and polymer physics of cellulose composites while also enabling readers to understand their history status and commercial challenges and future potential using a range of case studies and examples Other sections explore the applications of biomedical antibacterial water treatment flexible electronic devices energy storage and sensing and review recent developments problems and potential developmental directions of cellulose composites This book will appeal to chemists chemical engineers and materials scientists engaged in biomass cellulose nanocellulose composites surface science and related applied biomedical antibacterial water treatment flexible electronic device and energy storage fields Provides a comprehensive summary grounded in the surface chemistry and polymer physics of cellulose composites Covers the development history status and commercial challenges Explores applications in biomedical antibacterial water treatment flexible electronic devices energy storage and sensing Utilizes a range of case studies and useful examples Includes a forward looking emphasis on the sustainability of cellulose derived materials

*Surface Science* Russell Howe, Robert N. Lamb, Klaus Wandelt, 2011-12-10 Surface science has existed as a recognized discipline for more than 20 years During this period the subject has expanded in two important ways On the one hand the techniques available for studying surfaces both

experimental and theoretical have grown in number and in sophistication On the other hand surface science has been applied to an increasing number of areas of technology such as catalysis semiconductor processing new materials development corrosion prevention adhesion and tribology There is however no sharp division between fundamental and applied surface science New techniques can immediately be applied to technologically important problems Improvements in understanding of fundamental phenomena such as epitaxial growth of one metal on another or the bonding of hydrocarbons to metal surfaces to name just two examples have direct consequences for technology Surface science has also become very much an interdisciplinary subject physics chemistry materials science chemical and electrical engineering all draw upon and contribute to surface science The intimate relationship between principles and applications of surface science forms the theme of this proceedings volume The contributions were all presented as invited lectures at an Australian German Workshop on Surface Science held at Coogee Beach Sydney Australia in December 1991 The contributors all active surface scientists in their respective countries were asked to highlight recent developments in their own areas of activity involving new techniques advances in fundamental understanding or new applications in technology **Surface Science K.**

Oura,V.G. Lifshits,A.A. Saranin,A.V. Zotov,M. Katayama,2013-03-14 Designed as a textbook for advanced undergraduate and graduate students in engineering and physical sciences who are seeking a general overview of surface science this book also provides the necessary background for researchers just starting out in the field It covers all the most important aspects of modern surface science from the experimental background and crystallographic basics to modern analytical techniques and applications to thin films and nanostructures All topics are presented in a concise and clear form accessible to a beginner At the same time the coverage is comprehensive and at a high technical level with emphasis on the fundamental physical principles Numerous examples references practice exercises and problems complement this remarkably complete treatment which will also serve as an excellent reference for researchers and practitioners X-Ray Fluorescence Spectrometry and Its Applications to Archaeology Mary Kate Donais,David B. George,2018-05-30 This book serves as a practical guide for applications of X ray fluorescence spectrometry a nondestructive elemental analysis technique to the study and understanding of archaeology Descriptions of XRF theory and instrumentation and an introduction to field applications and practical aspects of archaeology provide new users to XRF and or new to archaeology with a solid foundation on which to base further study Considering recent trends within field archaeology information specific to portable instrumentation also is provided Discussions of qualitative and quantitative approaches and applications of statistical methods relate back to types of archaeological questions answerable through XRF analysis Numerous examples figures and spectra from the authors field work are provided including chapters specific to pigments ceramics glass construction materials and metallurgical materials

*High Magnetic Field Science and Its Application in the United States* National Research Council,Division on Engineering and Physical Sciences,Board on Physics and Astronomy,Committee to Assess the Current Status and Future Direction of High

Magnetic Field Science in the United States, 2013-12-25 The Committee to Assess the Current Status and Future Direction of High Magnetic Field Science in the United States was convened by the National Research Council in response to a request by the National Science Foundation This report answers three questions 1 What is the current state of high field magnet science engineering and technology in the United States and are there any conspicuous needs to be addressed 2 What are the current science drivers and which scientific opportunities and challenges can be anticipated over the next ten years 3 What are the principal existing and planned high magnetic field facilities outside of the United States what roles have U S high field magnet development efforts played in developing those facilities and what potentials exist for further international collaboration in this area A magnetic field is produced by an electrical current in a metal coil This current exerts an expansive force on the coil and a magnetic field is high if it challenges the strength and current carrying capacity of the materials that create the field Although lower magnetic fields can be achieved using commercially available magnets research in the highest achievable fields has been and will continue to be most often performed in large research centers that possess the materials and systems know how for forefront research Only a few high field centers exist around the world in the United States the principal center is the National High Magnetic Field Laboratory NHMFL High Magnetic Field Science and Its Application in the United States considers continued support for a centralized high field facility such as NHMFL to be the highest priority This report contains a recommendation for the funding and siting of several new high field nuclear magnetic resonance magnets at user facilities in different regions of the United States Continued advancement in high magnetic field science requires substantial investments in magnets with enhanced capabilities High Magnetic Field Science and Its Application in the United States contains recommendations for the further development of all superconducting hybrid and higher field pulsed magnets that meet ambitious but achievable goals

*Scanning Tunneling Microscopy and Its Application* Chunli Bai, 2000-08-10 This book presents a unified view of the rapidly growing field of scanning tunneling microscopy and its many derivatives After examining novel scanning probe techniques and the instrumentation and methods the book provides detailed accounts of STM applications It examines limitations of the present day investigations and provides insight into further trends I strongly recommend that Professor Bai's book be a part of any library that serves surface scientists biochemists biophysicists material scientists and students of any science or engineering field There is no doubt that this is one of the better most thoughtful texts Journal of the American Chemical Society Review of 1 e

*Sensors and Their Applications XII* S. J. Prosser, E. Lewis, 2003-09-01 Sensors and Their Applications XII discusses novel research in the areas of sensors and transducers and provides insight into new and topical applications of this technology It covers the underlying physics fabrication technologies and commercial applications of sensors Some of the topics discussed include optical sensing sensing materials no

Nanoscale Spectroscopy and Its Applications to Semiconductor Research Y. Watanabe, S. Heun, G. Salvati, N. Yamamoto, 2008-01-11 Fabrication technologies for

nanostructured devices have been developed recently and the electrical and optical properties of such nanostructures are a subject of advanced research This book describes the different approaches to spectroscopic microscopy i e Electron Beam Probe Spectroscopy Spectroscopic Photoelectron Microscopy and Scanning Probe Spectroscopy It will be useful as a compact source of reference for the experienced researcher taking into account at the same time the needs of postgraduate students and nonspecialist researchers by using a tutorial approach throughout Current Trends of Surface Science and Catalysis

Jeong Young Park,2013-10-23 This unique book covers the latest surface science studies on model catalysts including single crystals non colloidal nanocatalysts and nanoparticles in various forms with the control of size shape and composition This book addresses the issue of bridging materials and pressure gaps and also discusses the important issue of metal oxide interface and hot electron flows in heterogeneous catalysis The current development of in situ surface techniques that is relevant to bridging pressure gaps is also highlighted **The Surface Science of Metal Oxides** Victor E. Henrich,P. A. Cox,1994 Publisher Description

**21st Century Surface Science** Phuong Pham,Pratibha Goel,Samir Kumar,Kavita Yadav,2020-11-26 Surface sciences elucidate the physical and chemical aspects of the surfaces and interfaces of materials Of great interest in this field are nanomaterials which have recently experienced breakthroughs in synthesis and application As such this book presents some recent representative achievements in the field of surface science including synthesis techniques surface modifications nanoparticle based smart coatings wettability of different surfaces physics chemistry characterizations and growth kinetics of thin films In addition the book illustrates some of the important applications related to silicon CVD graphene graphene oxide transition metal dichalcogenides carbon nanotubes carbon nanoparticles transparent conducting oxide and metal oxides Surface Science Fernando A. Ponce,1991 **Proceedings of the International Conference on Colloid and Surface Science** Y. Iwasawa,N. Oyama,H. Kunieda,2001-02-15 The purpose of this Conference was to discuss the results of recent developments and the future prospect in science and technology of the field The field has been growing and flourishing while indicating many problems to be uncovered and solved The conference was structured to encourage interaction and to stimulate the exchange of ideas to accomplish the above purpose Key issues and materials related to the Conference were included as follows Molecular Assemblies in Solutions Fine Particles and Colloidal Dispersions Supramolecular Organized Films Nanostructural Solid Surfaces Industrial Applications and Products The Conference comprised 2 plenary lectures 42 invited lectures 150 oral presentations and 266 poster presentations

**Introduction to Surface Chemistry and Catalysis** Gabor A. Somorjai,Yimin Li,2010-06-08 Now updated the current state of development of modern surface science Since the publication of the first edition of this book molecular surface chemistry and catalysis science have developed rapidly and expanded into fields where atomic scale and molecular information were previously not available This revised edition of Introduction to Surface Chemistry and Catalysis reflects this increase of information in virtually every chapter It emphasizes the modern concepts of surface chemistry and catalysis

uncovered by breakthroughs in molecular level studies of surfaces over the past three decades while serving as a reference source for data and concepts related to properties of surfaces and interfaces The book opens with a brief history of the evolution of surface chemistry and reviews the nature of various surfaces and interfaces encountered in everyday life New research in two crucial areas nanomaterials and polymer and biopolymer interfaces is emphasized while important applications in tribology and catalysis producing chemicals and fuels with high turnover and selectivity are addressed The basic concepts surrounding various properties of surfaces such as structure thermodynamics dynamics electrical properties and surface chemical bonds are presented The techniques of atomic and molecular scale studies of surfaces are listed with references to up to date review papers For advanced readers this book covers recent developments in in situ surface analysis such as high pressure scanning tunneling microscopy ambient pressure X ray photoelectron spectroscopy and sum frequency generation vibrational spectroscopy SFG Tables listing surface structures and data summarizing the kinetics of catalytic reactions over metal surfaces are also included New to this edition A discussion of new physical and chemical properties of nanoparticles Ways to utilize new surface science techniques to study properties of polymers reaction intermediates and mobility of atoms and molecules at surfaces Molecular level studies on the origin of the selectivity for several catalytic reactions A microscopic understanding of mechanical properties of surfaces Updated tables of experimental data A new chapter on soft surfaces polymers and biointerfaces Introduction to Surface Chemistry and Catalysis serves as a textbook for undergraduate and graduate students taking advanced courses in physics chemistry engineering and materials science as well as researchers in surface science catalysis science and their applications

**Frontiers in Surface Science and Interface Science** C.B. Duke,E. Ward Plummer,2002-05-21 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

*Advances in Computer Science and its Applications* Hwa Young Jeong,Mohammad S. Obaidat,Neil Y. Yen,James J. (Jong Hyuk) Park,2013-11-23 These proceedings focus on various aspects of computer science and its applications thus providing an opportunity for academic and industry professionals to discuss the latest issues and progress in this and related areas The book includes theory and applications alike

*Surface Science and Its Applications* Osvaldo de Melo,Isaac Hernández-Calderón,2000 This book presents the proceedings of the Ninth Latin American Congress on Surface Science and

Its Applications The topics include recent advances in catalysis electronic structural properties imaging and analysis of surfaces and interfaces growth and characterization of thin films and vacuum and instrumentation     *Sensors and Biosensors, MEMS Technologies and its Applications* Sergey Yurish, 2014-07-14 Sensors and Biosensors MEMS Technologies and its Applications Book Series Advances in Sensors Reviews Vol 2 18 chapters with sensor related state of the art reviews and descriptions of the latest achievements written by experts from academia and industry from 12 countries China India Iran Malaysia Poland Singapore Spain Taiwan Thailand UK Ukraine and USA This volume is divided into three main parts physical sensors biosensors nanoparticles MEMS technologies and applications With this unique combination of information in each volume the Advances in Sensors Reviews Book Series will be of value for scientists and engineers in industry and at universities to sensors developers distributors and users Like the 1st volume of this Book Series the 2nd volume also has been organized by topics of high interest



## **Surface Science And Its Applications** Book Review: Unveiling the Magic of Language

In a digital era where connections and knowledge reign supreme, the enchanting power of language has are more apparent than ever. Its capability to stir emotions, provoke thought, and instigate transformation is truly remarkable. This extraordinary book, aptly titled "**Surface Science And Its Applications**," compiled by a highly acclaimed author, immerses readers in a captivating exploration of the significance of language and its profound impact on our existence. Throughout this critique, we shall delve to the book is central themes, evaluate its unique writing style, and assess its overall influence on its readership.

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