

Marek Procházka

Surface- Enhanced Raman Spectroscopy

Bioanalytical, Biomolecular and Medical
Applications

Pdf Surface Enhanced Raman Spectroscopy Bioanalytical Biomolecular

Helmut H. Telle, Ángel González Ureña



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Surface-Enhanced Raman Spectroscopy Marek Prochazka, 2015-12-12 This book gives an overview of recent developments in RS and SERS for sensing and biosensing considering also limitations possibilities and prospects of this technique Raman scattering RS is a widely used vibrational technique providing highly specific molecular spectral patterns A severe limitation for the application of this spectroscopic technique lies in the low cross section of RS Surface enhanced Raman scattering SERS spectroscopy overcomes this problem by 6 11 orders of magnitude enhancement compared with the standard RS for molecules in the close vicinity of certain rough metal surfaces Thus SERS combines molecular fingerprint specificity with potential single molecule sensitivity Due to the recent development of new SERS active substrates labeling and derivatization chemistry as well as new instrumentations SERS became a very promising tool for many varied applications including bioanalytical studies and sensing Both intrinsic and extrinsic SERS biosensing schemes have been employed to detect and identify small molecules nucleic acids and proteins and also for cellular and in vivo sensing

Introduction to Nanoscience and Nanotechnology Gabor L. Hornyak, H.F. Tibbals, Joydeep Dutta, John J. Moore, 2008-12-22 The maturation of nanotechnology has revealed it to be a unique and distinct discipline rather than a specialization within a larger field Its textbook cannot afford to be a chemistry physics or engineering text focused on nano It must be an integrated multidisciplinary and specifically nano textbook The archetype of the modern nano textbook *Laser Spectroscopy and Laser Imaging* Helmut H. Telle, Ángel González Ureña, 2018-04-17 a very valuable book for graduate students and researchers in the field of Laser Spectroscopy which I can fully recommend Wolfgang Demtröder Kaiserslautern University of Technology How would it be possible to provide a coherent picture of this field given all the techniques available today The authors have taken on this daunting task in this impressive groundbreaking text Readers will benefit from the broad overview of basic concepts focusing on practical scientific and real life applications of laser spectroscopic analysis and imaging Chapters follow a consistent structure beginning with a succinct summary of key principles and concepts followed by an overview of applications advantages and pitfalls and finally a brief discussion of seminal advances and current developments The examples used in this text span physics and chemistry to environmental science biology and medicine Focuses on practical use in the laboratory and real world applications Covers the basic concepts common experimental setups Highlights advantages and caveats of the techniques Concludes each chapter with a snapshot of cutting edge advances This book is appropriate for anyone in the physical sciences biology or medicine looking for an introduction to laser spectroscopic and imaging methodologies Helmut H Telle is a full professor at the Instituto Pluridisciplinar Universidad Complutense de Madrid Spain ngel Gonz lez Ure a is head of the Department of Molecular Beams and Lasers Instituto Pluridisciplinar Universidad Complutense de Madrid Spain **Fundamentals of Nanotechnology** Gabor L. Hornyak, John J. Moore, H.F. Tibbals, Joydeep Dutta, 2018-12-14 WINNER 2009 CHOICE AWARD OUTSTANDING ACADEMIC TITLE Nanotechnology is no

longer a subdiscipline of chemistry engineering or any other field It represents the convergence of many fields and therefore demands a new paradigm for teaching This textbook is for the next generation of nanotechnologists It surveys the field s broad landscape exploring the physical basics such as nanorheology nanofluidics and nanomechanics as well as industrial concerns such as manufacturing reliability and safety The authors then explore the vast range of nanomaterials and systematically outline devices and applications in various industrial sectors This color text is an ideal companion to Introduction to Nanoscience by the same group of esteemed authors Both titles are also available as the single volume Introduction to Nanoscience and Nanotechnology Qualifying instructors who purchase either of these volumes or the combined set are given online access to a wealth of instructional materials These include detailed lecture notes review summaries slides exercises and more The authors provide enough material for both one and two semester courses

Electrochemical Aptamer-Based Biosensors for Disease Biomarkers Masoud Negahdary, 2025-07-01

Electrochemical Aptamer Based Biosensors for Disease Biomarkers comprehensively presents the principles of designing aptamer based biosensors for disease detection using biomarkers The book considers the latest research and discusses the application of aptasensors design against different diseases In addition sections explore innovative types of electrochemical diagnostic techniques used based on various advanced elements and assemblies such as nanomaterials and signal transducers This is an effective practical guide for researchers to use as a reference for the development of their own laboratory research Covers the collection classification and comparison of recent research in the design of electrochemical aptasensors for the diagnosis of various diseases Presents reviews and compares all applied detection mechanisms in developed aptasensors Provides a practical guide for designing electrochemical aptasensors and showing how to select the optimal components in their design

Nanosensors Vinod Kumar Khanna, 2021-02-25 Nanosensors are innovative devices that exploit the unique properties exhibited by matter at the nanoscale A growing and exciting field nanosensors have recently spurred considerable research endeavors across the globe driving a need for the development of new device concepts and engineering nanostructured materials with controlled properties Nanosensors Physical Chemical and Biological Second Edition offers a panoramic view of the field and related nanotechnologies with extraordinary clarity and depth Presenting an interdisciplinary approach blending physics chemistry and biology this new edition is broad in scope and organised into six parts beginning with the fundamentals before moving onto nanomaterials and nanofabrication technologies in the second part The third and fourth parts provide a critical appraisal of physical nanosensors and explore the chemical and biological categories of nanosensors The fifth part sheds light on the emerging applications of nanosensors in the sectors of society industry and defense and details the cutting edge applications of state of the art nanosensors in environmental science food technology medical diagnostics and biotechnology The final part addresses self powering and networking issues of nanosensors and provides glimpses of future trends This is an ideal reference for researchers and industry professionals

engaged in the frontier areas of material science and semiconductor fabrication as well as graduate students in physics and engineering pursuing electrical engineering and electronics courses with a focus on nanoscience and nanotechnology Key features Provides an updated all encompassing exploration of contemporary nanosensors and highlights the exclusive nanoscale properties on which nanosensors are designed Presents an accessible approach with a question and answer format to allow an easy grasp of the intricacies involved in the complex working mechanisms of devices Contains clear illustrative diagrams enabling the visualization of nanosensor operations along with worked examples end of chapter questions and exhaustive up to date bibliographies appended to each chapter

Directory of Graduate Research American Chemical Society. Committee on Professional Training, 2005 Faculties publications and doctoral theses in departments or divisions of chemistry chemical engineering biochemistry and pharmaceutical and or medicinal chemistry at universities in the United States and Canada

Surface Enhanced Raman Spectroscopy: Biosensing and Diagnostic Technique for Healthcare Applications Swati Jain, 2021-12-28 Surface enhanced Raman spectroscopy SERS is a technique applied in multidisciplinary research Its use has tremendously grown in the last 40 years owing to improved nanofabrication biomolecules extraction and sensitive signal acquisition techniques This book focuses on the underlying principles of SERS by emphasizing on basic concepts and background information about the subject Chapters explain the physics of Raman spectroscopy while also indicating its relevance to designing protocols and methodologies for biosensing and imaging The book gives updated and recent details on colloids and nanostructures their fabrication surface engineering and immobilization methods all in context to SERS based biosensing Key Features Covers basic knowledge and new research about surface enhanced Raman spectroscopy SERS Provides a complete framework on SERS based biosensing with concise chapters Focuses on different active molecules critical to SERS and associated developed nanoassemblies Presents information about ongoing research on SERS imaging applications Highlights bottlenecks of SERS technique in biosensing Includes references for further reading This book serves as a reference book for researchers and academicians and will also provide a reasonable understanding on the topic of SERS to newcomers irrespective of their background in a simple manner The book is of interest to all readers within the scientific community involved with Raman spectroscopy including chemists physicists biologists material scientists as well as biomedical engineers

Surface-enhanced Raman Spectroscopy Jürgen Popp, 2009 Using Surface-enhanced Raman Spectroscopy Chips to Detect Biomolecules on Cell Membrane Platforms [?], 2024

TOWARDS EFFICIENT DETECTION AND IDENTIFICATION OF SINGLE BIOMOLECULES BY SURFACE-ENHANCED RAMAN SCATTERING. , 2000 **Applications of Raman Spectroscopy to Biology** M. Ghomi, 2012-02-23 Raman spectroscopy

has been known and used as a technique for 80 years originally for the study of inorganic substances Recent advances in underlying technology such as lasers detectors filters and components have transformed the technique into a very effective modern tool for studying complex biological problems Professor Mahmoud Ghomi of the University of Paris XIII has edited

this book on the applications of Raman spectroscopy to biology covering in a readily accessible way the area from basic studies to the diagnosis of disease The early chapters provide background information on basic principles underlying the main Raman methods covered in the book with information on Surface Enhanced Raman Scattering SERS and Surface Enhanced Fluorescence SEF as well as giving accounts of applications to biomolecular and cellular investigations Among the topics covered are studies of drugs and their complexes with biomolecules on nanoparticles application of SERS to blood analysis studies of single cells and of applications to human cancer diagnostics This will be a useful book for experimental scientists in academic governmental industrial and clinical environments and for those entering the field of biomolecular spectroscopy

Raman Spectroscopy Dheeraj Kumar Singh, Ashish Kumar Mishra, Arnulf Materny, 2024-04-22 This book highlights recent advances of spectroscopic techniques based on Raman scattering Different applications are introduced that serve as examples for the versatile use of Raman techniques Raman spectroscopy is a marker free technique which is capable of yielding detailed information about molecular systems in a non destructive way This makes it a valuable tool for e g material science or medical research The access to vibrational energy and dynamics yields fundamental insights into static and dynamical structural properties of molecules being influenced by and influencing their material science or medical research environment The better understanding of the basic building blocks of materials helps to improve the functionality in various applications Raman spectroscopy has become a truly interdisciplinary research tool and the ongoing development of techniques makes it attractive for growing variety of scientific and industrial applications which will be demonstrated in the book While the classical linear spontaneous Raman spectroscopy is restricted in its applicability due to low signal intensities or the excitation of strong fluorescence background new techniques have helped to overcome such problems Examples presented in the book are surface enhanced Raman scattering SERS and various associated techniques are used to drastically increase signal intensity confocal and tip enhanced Raman scattering TERS allowing for high and even sub diffraction limited spatial resolutions coherent anti Stokes Raman scattering CARS avoiding fluorescence background and allowing for time resolved observations of vibrational dynamics or hyper and resonance Raman scattering influencing the scattering based on electronic resonances etc

Surface Enhanced Raman Spectroscopy Sebastian Schlücker, 2011-09-19 Covering everything from the basic theoretical and practical knowledge to new exciting developments in the field with a focus on analytical and life science applications this monograph shows how to apply surface enhanced Raman scattering SERS for solving real world problems From the contents Theory and practice of SERS Analytical applications SERS combined with other analytical techniques Biophysical applications Life science applications including various microscopies Aimed at analytical surface and medicinal chemists spectroscopists biophysicists and materials scientists Includes a Foreword by the renowned Raman spectroscopist Professor Wolfgang Kiefer the former Editor in Chief of the Journal of Raman Spectroscopy

Raman and Surface Enhanced Raman Scattering of Biomolecules and Materials for Hydrogen Storage and

Delivery Leo B. Seballos, 2007 Fabrication and Testing of Surface-enhanced Raman Spectroscopy Substrates for the Detection of Biomolecules Robert F. Peters, University of Alberta. Department of Electrical and Computer Engineering, 2014

Biosensing involves the detection of analytes using biological elements as receptor agents for the specific binding of molecules to a surface Surface enhanced Raman spectroscopy SERS a surface sensitive vibrational spectroscopy technique used to amplify Raman signals provides unique advantages for biosensing Unique Raman fingerprint spectra of targeted molecules allows for accurate identification of unknown samples Inconsistencies in Raman signal enhancements however due to the irregularities of metallic features at the nanoscale is a significant challenge with SERS Nanofabrication technologies including electron beam lithography EBL and nanoimprint lithography NIL provide resolution capabilities at the nanoscale In this work nanofabrication methods were used to fabricate SERS substrates for the detection of analytes using various immobilization strategies Control over signal intensity and detection of biological bonding with analytes in aqueous solutions was demonstrated Investigations and testing of various aspects in the fabrication processes allowed for significant control over features at nanoscale dimensions *Development of Fast Biomolecules Detection Technique Using Raman Spectroscopy and Surface-Enhanced Raman Spectroscopy in Microdialysis Integration and Antibiotic Resistant Bacteria Identification* [1], 2010

Surface Enhanced Raman Spectroscopy for Biophysical Applications Claudia Fasolato, 2018-12-05 The book explores the phenomenon of surface enhanced Raman scattering SERS the huge amplification of Raman signal from molecules in the proximity of a metallic nanostructured surface allowing readers to gain an in depth understanding of the mechanisms affecting the spectroscopic response of SERS active systems for effective applications SERS spectroscopy is an ultrasensitive analytical technique with great potential for applications in the field of biophysics and nanomedicine As examples the author presents the design of nanocolloid based SERS active substrates for molecular sensing and of a folate based SERS active nanosensor capable of selectively interacting with cancer cells enabling cancer diagnostics and therapy at the single cell level The author also suggests novel paths for the systematization of the SERS nanosystem design and experimental protocols to maximize sensitivity and reproducibility which is essential when real world biomedical applications are the goal of the study With a combined approach both fundamental and applied and a detailed analysis of the state of the art this book provides a valuable overview both for students new to SERS spectroscopy and for experts in the field

Raman Spectroscopy Gustavo Morari Do Nascimento, 2018-04-18 This book gives a wide overview of the state of the art applications of Raman spectroscopy in characterization of materials and biomaterials The Raman signal is intrinsically smaller than other vibrational techniques however mainly through intensification processes such as resonance Raman RR and surface enhanced Raman spectroscopy SERS the Raman cross section can be strongly amplified Thoroughly in these signal amplifications the study of a diversity of chemical systems and the use of Raman technique for in situ and in vivo measurements is possible The main goal of this book is to open up to an extended audience the possibilities of uses of Raman

spectroscopy In fact this collective work will be beneficial to students teachers and researchers of many areas who are interested to expand their knowledge about Raman spectroscopy applied to nanotechnology biotechnology environmental science inorganic chemistry and health sciences *Surface-Enhanced Raman Spectroscopy with High Spatial Resolution* T. R. Huser, 2003 The identification of individual molecules and the determination of how these interact with their local environment are critical steps toward a better understanding of complex organic systems Optical detection techniques have always played a key role in the nondestructive and noninvasive analysis of complex materials Until recently however optical microscopy has lacked the sensitivity to study processes on the molecular scale This has changed with the recent development of new schemes that limit the optical detection volume and the advent of new highly quantum efficient photon detectors These inventions have enabled researchers to optically probe biomolecular processes at the single molecule level by observing the fluorescence of specific marker molecules The requirement to specifically label biomolecules and the fact that fluorescence emission is prone to photodecomposition of the marker molecules however have limited this approach to a few well characterized case studies Raman scattering is one of few optical techniques that can identify atomic species and in addition determine their chemical bonds by observing their distinct vibrational fingerprints but it is orders of magnitude weaker than fluorescence In this project we have developed new optical probes that allow for the non destructive characterization and identification of organic and inorganic matter at the single molecule level by surface enhanced Raman spectroscopy Our approach combines confocal Raman microscopy with surface enhanced Raman spectroscopy SERS generated by coating scanning probe microscope SPM tips with thin 30 40 nm gold and silver films The scanning SERS probe generates an image of the physical structure of a sample together with detailed chemical information about its composition In a complementary approach we have also used gold or silver nanoparticles to generate SER spectra from single molecules adsorbed to these particles This project has led to the development of a new capability at LLNL i e the field of optical single molecule detection

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