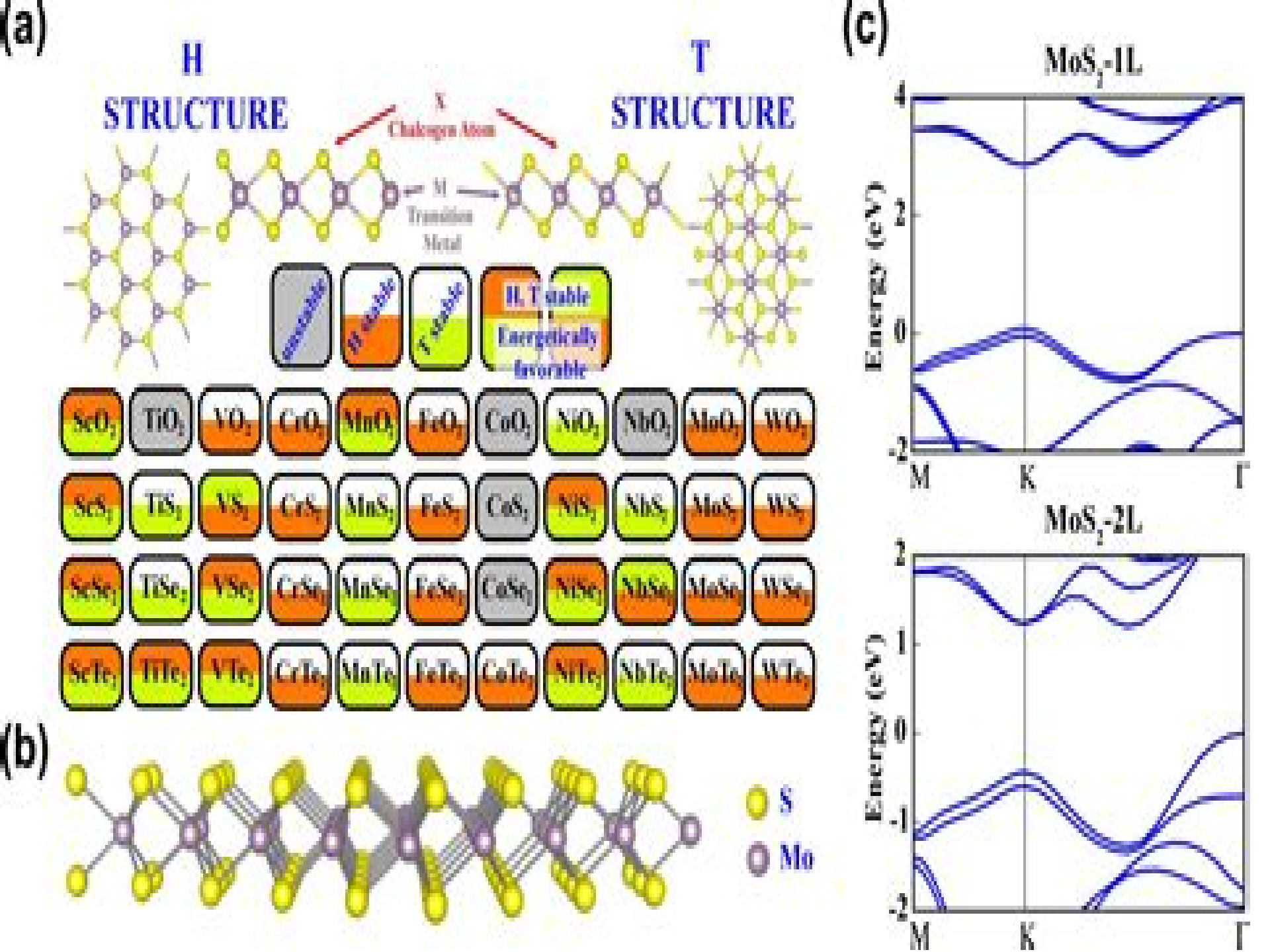
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Electronic Structure And Electronic Transitions In Layered Materials

Frank Schwierz

Electronic Structure And Electronic Transitions In Layered Materials:

Electronic Structure and Electronic Transitions in Layered Materials V. Grasso,2012-12-06 This new volume in the series Physics and Chemistry of Materials with Layered Structures satisfies the need for a comprehensive review of the progress made in the decade 1972 1982 in the field of the electronic properties of layer compounds Some recent theoretical and experimental developments are highlighted by authori tative physicists active in current research The previous books of this series covering similar topics are volumes 3 and 4 The present review is mainly intended to fulfill the gap up to 1982 and part of 1983 I am indebted to all the authors for their friendly co operation and continuous effort in preparing the contributions in their own fields of competence I am sure that both the expertise scientists and the beginners in the field of the electronic properties of layered materials will find this book a valuable tool for their research work Warm thanks are due to Prof E Mooser General Editor of the series for his constant and authoritative advice This book has been conceived as a tribute to Prof Franco Bassani to whom the Italian tradition in the field of layer compounds as well as in other fields of solid state physics owes much The authors of this review have all benefited at some time of their professional life from close cooperation with him Istituto di Struttura della Materia VINCENZO GRASSO Universitd di Messina IX V Grasso ed Electronic Structure and Electronic Transitions in Layered Materials ix **Electronic Structure and Electronic Transitions in Layered Materials** V Grasso,1986-06-30 **Magnetic Properties of Layered Transition Metal Compounds** L.J. de Jongh,2012-12-06 In the last two decades low dimensional low d physics has matured into a major branch of science Quite generally we may define a system with restricted dimensionality d as an object that is infinite only in one or two spatial directions d 1 and 2 Such a definition comprises isolated single chains or layers but also fibres and thin layers films of varying but finite thickness Clearly a multitude of physical phenomena notably in solid state physics fall into these categories As examples we may mention Magnetic chains or layers thin film technology Metallic films homogeneous or heterogeneous crystalline amorphous or microcristalline etc I d or 2 d conductors and superconductors Intercalated systems 2 d electron gases electrons on helium semiconductor interfaces Surface layer problems 2 d melting of monolayers of noble gases on a substrate surface problems in general Superfluid films of He or He Polymer physics Organic and inorganic chain conductors superionic conductors I d or 2 d molecular crystals and liquid crystals I d or 2 d ferro and antiferro electrics **Electron Spectroscopies Applied to Low-Dimensional Structures** H.P. Hughes,H. Starnberg,2006-04-11 The effect of reduced dimensionality inherent at the crystallographic level on the electronic properties of low dimensional materials can be dramatic leading to structural and electronic instabilities including supercond tivity at high temperatures charge density waves and localisation which continue to attract widespread interest The layered transition metal dichalcogenides have engaged attention for many years partly arising from the charge density wave effects which some show and the controlled way in which their properties can be modified by intercalation while the development of epitaxial growth techniques has

opened up promising areas based on dichalcogenide heterostructures and quantum wells The discovery of high temperature superconducting oxides and the realisation that polymeric materials too can be exploited in a controlled way for various opto electronic applications have further sti lated interest in the effects of structural dimensionality It seems timely therefore to draw together some strands of recent research involving a range of disparate materials which share some common char teristics of low dimensionality This resulting volume is aimed at researchers with specialist interests in the particular materials discussed but who may also wish to examine the related phenomena observed in different systems and at a more general solid state audience with broad interests in electronic properties and low dimensional phenomena Space limitations have required us to be selective as regards particular materials though we have managed to include those as dissimilar as polymeric semiconductors superconducting oxides bronzes and layered chalcogenides *Two-Dimensional Electron Systems* E.Y. Andrei,2012-12-06 Recent studies on two dimensional systems have led to new insights into the fascinating interplay between physical properties and dimensionality Many of these ideas have emerged from work on electrons bound to the surface of a weakly polarizable substrate such as liquid helium or solid hydrogen The research on this subject continues to be at the forefront of modern condensed matter physics because of its fundamental simplicity as well as its connection to technologically useful devices This book is the first comprehensive overview of experimental and theoretical research in this exciting field It is intended to provide a coherent introduction for graduate students and non experts while at the same time serving as a reference source for active researchers in the field The chapters are written by individuals who made significant contributions and cover a variety of specialized topics These include the origin of the surface states tunneling and magneto tunneling out of these states the phase diagram collective excitations transport and magneto transport **New Horizons in Low-Dimensional Electron Systems** H. Aoki,M. Tsukada,M. Schlüter,F.A. Lévy,2012-12-06 In Bird of Passage by Rudolf Peierls we find a paragraph in which he de scribes his Cambridge days in the 1930s On these relativistic field theory problems my main contacts were Dirac and the younger theoreticians These included in particular Nevill now Sir Nevill Mott perhaps the friendliest among many kind and friendly people we met then Professor Kamimura became associated with Sir Rudolf Peierls in the 1950s when he translated with his colleagues Peierls s 1955 textbook Quantum Theory of Solids into Japanese This edition to which Sir Rudolf himself contributed a preface benefitted early generations of Japanese solid state physicists Later in 1974 5 during a sabbatical year spent at the Cavendish Laboratory Professor Kamimura met and began a long association with Sir Nevill Mott In particular they developed ideas for disordered systems One of the outcomes is a paper coauthored by them on ESR induced variable range hopping in doped semiconductors A series of works on disordered systems together with those on two dimensional systems have served as building blocks for Physics of Interacting Electrons in Disordered Systems in the International Series of Monographs on Physics coauthored by Aoki and published in 1989 by the Oxford University Press Soon after Professor Kamimura obtained a D Sc in 1959 for the work on the ligand field theory under

the supervision ofMasao Kotani his strong con nections in the international physical community began when he worked at the Bell Telephone Laboratories in 1961 64 Neutron Scattering in Layered Copper-Oxide Superconductors Albert Furrer,2012-12-06 The phenomenon of superconductivity after its discovery in metals such as mercury lead zinc etc by Kamerlingh Onnes in 19 has attracted many scientists Superconductivity was described in a very satisfactory manner by the model proposed by Bardeen Cooper and Schrieffer and by the extensions proposed by Abrikosov Gorkov and Eliashberg Relations were established between superconductivity and the fundamental properties of solids resulting in a possible upper limit of the critical temperature at about 23 K The breakthrough that revolutionized the field was made in 1986 by Bednorz and Muller with the discovery of high temperature superconductivity in layered copper oxide perovskites Today the record in transition temperature is 133 K for a Hg based cuprate system The last decade has not only seen a revolution in the size of the critical temperature but also in the myriads of research groups that entered the field In addition high temperature superconductivity became a real interdisciplinary topic and brought together physicists chemists and materials scientists who started to investigate the new compounds with almost all the available experimental techniques and theoretical methods As a consequence we have witnessed an avalanche of publications which has never occurred in any field of science so far and which makes it difficult for the individual to be thoroughly informed about the relevant results and trends Neutron scattering has outstanding properties in the elucidation of the basic properties of high temperature superconductors

Photoelectrochemistry and Photovoltaics of Layered Semiconductors A. Aruchamy,2013-03-13 This volume aims at bringing together the results of extensive research done during the last fifteen years on the interfacial photoelectronic properties of the inorganic layered semiconducting materials mainly in relation to solar energy conversion Significant contributions have been made both on the fundamental aspects of interface characteristics and on the suitability of the layered materials in photoelectrochemical semiconductor electrolyte junctions and in solid state photovoltaic Schottky and p n junctions cells New insights into the physical and chemical characteristics of the contact surfaces have been gained and many new applications of these materials have been revealed In particular the basal plane surface of the layered materials shows low chemical reactivity and specific electronic behaviour with respect to isotropic solids In electrochemical systems the inert nature of these surfaces characterized by saturated chemical bonds has been recognized from studies on charge transfer reactions and catalysis In addition studies on the role of the d band electronic transitions and the dynamics of the photogene rated charge carriers in the relative stability of the photoelectrodes of the transition metal dichalcogenides have deepened the understanding of the interfacial photoreactions Transition metal layered compounds are also recognized as ideal model compounds for the studies Involving surfaces photoreactions adsorption phenomena and catalysis scanning tunneling microscopy and spectroscopy and epitaxial growth of thin films Recently quantum size effects have been investigated in layered semiconductor colloids New Trends in Intercalation Compounds for Energy Storage Christian

Julien,J.P. Pereira-Ramos,A. Momchilov,2012-12-06 Recent advances in electrochemistry and materials science have opened the way to the evolution of entirely new types of energy storage systems rechargeable lithium ion batteries electrochroms hydrogen containers etc all of which have greatly improved electrical performance and other desirable characteristics This book encompasses all the disciplines linked in the progress from fundamentals to applications from description and modelling of different materials to technological use from general diagnostics to methods related to technological control and operation of intercalation compounds Designing devices with higher specific energy and power will require a more profound understanding of material properties and performance This book covers the status of materials and advanced activities based on the development of new substances for energy storage **Carbyne and Carbynoid Structures** R.B. Heimann,S.E. Evsyukov,Ladislav Kavan,2012-12-06 1 1 THE DISCOVERY OF CARBYNE Yu P KUDRYA VTSEV A N Nesmeyanov Institute ofOrganoelement Compounds Russian Academy of Sciences 117813 Moscow Russia Abstract The history of the discovery of carbyne is briefly recalled The existence of carbyne was first disclosed by Russian researchers in 1960 It was obtained for the first time via oxidative dehydropolycondensation of acetylene based on the Glaser coupling of ethynyl compounds 1 Introduction The polymeric nature of carbon was first pointed out by Mendeleev He wrote The molecules of coal graphite and diamond are very complicated and carbon atoms exhibit the capability of binding one to another to form complex molecules in all compounds of carbon None of the elements possesses an ability of complicating in such an extent as does carbon There is still no basis to define the polymerization degree of the coal graphite or diamond molecules One should believe however that they contain en species where n is a large value IJ Until the 1960s only two allotropic forms of carbon were known viz graphite and diamond including their polymorphous modifications For a long time amorphous carbon was also included among the simple forms Presently however the structure of amorphous and quasi amorphous carbons such as carbon blacks soot cokes glassy carbon etc is known to approach that of graphite to various degrees 2J **Nuclear Spectroscopy on Charge Density Wave Systems** T. Butz,2013-04-17 Nuclear magnetic resonance NMR nuclear quadrupole resonance NQR time differential perturbed angular correlations TDPAC and the M ssbauer effect ME have been applied to the study of charge density wave CDW systems These hyperfine techniques provide unique tools to probe the structure and symmetry of commensurate CDWs give a clear fingerprint of incommensurate CDWs and are ideally suited for CDW dynamics This book represents a new attempt in the series Physics and Chemistry of Materials with Low dimensional Structures to bring together a consistent group of scientific results obtained by nuclear spectroscopy related to CDW phenomena in pseudo one and two dimensional systems The individual chapters contain the theory of CDWs in chain like transition metal tetrachalcogenides NMR NQR TDPAC and ME investigations of layered transition metal dichalcogenides NMR studies of CDW transport in chain like NbSe3 and molybdenum bronzes multinuclear NMR of KCP high resolution NMR of organic conductors This book is of interest to graduate students and all scientists who want to acquire a broader knowledge of nuclear spectroscopy techniques

applied to CDW systems **Physics and Chemistry of Metal Cluster Compounds** L.J. de Jongh,2013-03-09 On Friday February 20 1980 I had the pleasure to be present at the inaugural lecture of my colleague Jan Reedijk who had just been named at the Chair of Inorganic Chemistry of Leiden University According to tradition the ceremony took place in the impressive Hall of the old University Academy Building In the course of his lecture Jan mentioned a number of recent developments in chemistry which had struck him as particularly important or interesting Among those was the synthesis of large metal cluster compounds and to my luck he showed a slide ofthe molecular structure of PtI9 C b 4 To my luck since at traditional Leiden University it is quite unusual to show slides at such ceremonies This constituted my first acquaintance with this exciting new class of materials I became immediately fascinated by this molecule partly because of the esthetic beauty of its fivefold symmetry partly because as a physicist it struck me that it could be visualized as an embryonically small metal particle embedded in a shell of CO ligands 2D Transition-Metal Dichalcogenides (TMDs): Fundamentals and Application Abhay Kumar Singh,2025-01-18 This book offers to reader a sound understating of two dimensional Transition Metal Dichalcogenides 2D TMDs materials detailing their physio chemical mechanisms and technological applications in various areas such as nanoelectronics and optoelectronics Moving from their invention to their modern developments including theoretical approaches experimental interpretations and their technical applications the book explores the basic concepts of 2D TMDs It will be of interest to undergraduate and postgraduate students researchers and scientists working in the area of 2D TMDs A key goal of this book provides a sound or clear idea about two dimensional Transition Metal Dichalcogenides 2D TMDs materials by providing their sound background fabrication approaches including interpretations of the inside physio chemical mechanism including technological applications in various significant areas such as nanoelectronics optoelectronics topological insulators biomedical **Biomedical Applications of Graphene and 2D Nanomaterials** Md Nurunnabi,Jason McCarthy,2019-03-31 Biomedical Applications of Graphene and 2D Nanomaterials provides a much needed reference on the biomedical applications of 2D nanomaterials as well as theoretical knowledge on their structure physicochemical properties and biomedical applications Chapters are dedicated to growth areas such as size and shape dependent chemical and physical properties and applications such as in diagnostic and therapeutic products The book also discusses the concept development and preclinical studies of 2D nanomaterials based biomedical tools such as biosensors artificial organs and photomedicine Case studies and reports form the core of the book making it an ideal resource on potential applications in biomedical science and engineering This timely resource for scientists and engineers in this rapidly advancing field features contributions from over 30 leaders who address advanced methods and strategies for controlling the physical chemical properties of 2D nanomaterials along with expert opinions on a range of 2D nanomaterials that have therapeutic and diagnostic applications Presents advanced methods and strategies for controlling the physical chemical properties of 2D nanomaterials Provides state of the art biomedical applications for 2D nanomaterials including graphene and boron nitride

Includes key information from a broad selection of subject areas for researchers in both materials engineering and medicine

Electron Transfer in Nanomaterials Garry Rumbles,Tim Lian,Kei Murakoshi,2006 *Semiconductor Photochemistry And Photophysics/Volume Ten* V. Ramamurthy,Kirk S. Schanze,2003-02-11 Answering the need for information that could revolutionize the development of alternate solar energy sources and the reduction of atmospheric contaminants Semiconductor Photochemistry and Photophysics reflects renewed interest inspired by the unique properties of nanocrystalline semiconductor particles It provides a thorough overview and describes fundamental research aimed at understanding the underlying mechanisms of the cells and looks at the application of nanocrystalline TiO2 as a photocatalyst for environmental remediation Key topics include semiconductor photoelectrochemistry dye sensitized solar cells and photocatalytic treatment of chemical waste *Two-Dimensional Electronics - Prospects and Challenges* Frank Schwierz,2018-09-27 This book is a printed edition of the Special Issue Two Dimensional Electronics Prospects and Challenges that was published in Electronics *Intercalation in Layered Materials* M.S. Dresselhaus,2013-12-19 This volume is prepared from lecture notes for the course Intercalation in Layered Materials which was held at the Ettore Majorana Centre for Scientific Culture at Erice Sicily in July 1986 as part of the International School of Materials Science and Tech nology The course itself consisted of formal tutorial lectures workshops and informal discussions Lecture notes were prepared for the formal lectures and short summaries of many of the workshop presentations were prepared This volume is based on these lecture notes and research summaries The material is addressed to advanced graduate students and postdoctoral researchers and assumes a background in basic solid state physics The goals of this volume on Intercalation in Layered Materials include an introduc tion to the field for potential new participants an in depth and broad exposure for stu dents and young investigators already working in the field a basis for cross fertilization between workers on various layered host materials and with various intercalants and an elaboration of the complementarity of intercalated layered materials with deliberately structured superlattices **Surface Analysis with STM and AFM** Sergei N. Magonov,Myung-Hwan Whangbo,2008-09-26 Scanning tunneling microscopy STM and atomic force microscopy AFM are powerful tools for surface examination In the past many STM and AFM studies led to erroneous conclusions due to lack of proper theoretical considerations and of an understanding of how image patterns are affected by measurement conditions For this book two world experts one on theoretical analysis and the other on experimental characterization have joined forces to bring together essential components of STM and AFM studies The practical aspects of STM the image simulation by surface electron density plot calculations and the qualitative evaluation of tip force induced surface corrugations Practical examples are taken from inorganic layered materials organic conductors organic adsorbates at liquid solid interfaces self assembled amphiphiles polymers This book will be an invaluable reference work for researchers active in STM and AMF as well as for newcomers to the field *Theory of Unconventional Superconductors* Dirk Manske,2004-06-25 This book presents a theory for

unconventional superconductivity driven by spin excitations Using the Hubbard Hamiltonian and a self consistent treatment of the spin excitations the interplay between magnetism and superconductivity in various unconventional superconductors is discussed In particular the monograph applies this theory for Cooper pairing due to the exchange of spin fluctuations to the case of singlet pairing in hole and electron doped high Tc superconductors and to triplet pairing in Sr2RuO4 Within the framework of a generalized Eliashberg like treatment calculations of both many normal and superconducting properties as well as elementary excitations are performed The results are related to the phase diagrams of the materials which reflect the interaction between magnetism and superconductivity

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