

Polycrystalline Semiconductors

Physical Properties
and Applications

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**Polycrystalline Semiconductors Physical Properties And
Applications Springer Series In Solid State Sciences
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Katrin Zwirgmaier



Polycrystalline Semiconductors Physical Properties And Applications Springer Series In Solid State Sciences Volume 57:

Polycrystalline Semiconductors G. Harbeke, 2012-12-06 In terms of structure the field of semiconductors spans a wide range from the perfect order of single crystals to the non periodic disordered amorphous state The two extremes of this range attract a large amount of interest On one side glamorous novel phenomena are being found which can only occur in specially tailored ultra perfect periodic lattices On the other side the exotic and challenging nature of the amorphous state has triggered a surge of activity in recent years Polycrystalline semiconductors are in between They are among the work horses in the field useful in many applications a handy solution to many practical problems and still they have not received in the past the amount of research interest that they deserve It is the aim of the present book to improve this situation The book originated from the lectures and seminars presented at the course on Polycrystalline Semiconductors Physical Properties and Applications of the International School on Materials Science and Technology held at the Centre for Scientific Culture Ettore Majorana in Erice Italy July 1-15 1984

Heterojunctions and Semiconductor Superlattices Guy Allan, Gerald Bastard, Nino Boccara, Michel Lannoo, Michel Voos, 2012-12-06 The Winter School held in Les Houches on March 12-21 1985 was devoted to Semiconductor Heterojunctions and Superlattices a topic which is recognized as being now one of the most interesting and active fields in semiconductor physics In fact following the pioneering work of Esaki and Tsu in 1970 the study of these two dimensional semiconductor heterostructures has developed rapidly both from the point of view of basic physics and of applications For instance modulation doped heterojunctions are nowadays currently used to investigate the quantum Hall effect and to make very fast transistors This book contains the lectures presented at this Winter School showing in particular that many aspects of semiconductor heterojunctions and superlattices were treated extending from the fabrication of these two dimensional systems to their basic properties and applications in micro and optoelectronics Among the subjects which were covered one can quote as examples molecular beam epitaxy and metallorganic chemical vapor deposition of semiconductor compounds band structure of superlattices properties of electrons in heterojunctions including the fractional quantum Hall effect optical properties of two dimensional heterostructures quantum well lasers and two dimensional electron gas field effect transistors It is clear that two dimensional semiconductor systems are raising a great deal of interest in many industrial and university laboratories From the number of applications which were received and from the reactions of the participants it can certainly be asserted that this School corresponded to a need and came at the right time

Photonics Spectra, 1985

Semiconductor Physics Karlheinz Seeger, 2013-04-17 It is a pleasure to take the opportunity to express my sincere gratitude to many colleagues who provided valuable hints for improvements even including lists of misprints which I hope have now been completely eliminated It is not possible to name all of them and so I will only mention the interesting discussions over so many years I had with Professor Hans W Pötzl of the Technical

University of Vienna on the occasion of our common weekly semiconductor seminar I am grateful to Professor H J Queisser and Professor M Cardona for helpful criticism Special thanks are due to Frau Jitka Fucik for typing and Frau Viktoria Kver for drawing services The cooperation with Dr H K Lotsch of Springer Verlag has been a pleasure Vienna January 1982 K Seeger Contents 1 Elementary Properties of Semiconductors I 1 1 Insulator Semiconductor Semimetal Metal 1 1 2 The Positive Hole 3 1 3 Conduction Processes Compensation Law of Mass Action 4 Problems 8 2 Energy Band Structure 10 2 1 Single and Periodically Repeated Potential Well 10 2 2 Energy Bands by Tight Binding of Electrons to Atoms 17 2 3 The Brillouin Zone 21 2 4 Constant Energy Surfaces 30 Problems 33 3 Semiconductor Statistics 34 3 1 Fermi Statistics 35 3 2 Occupation Probabilities of Impurity Levels 39 Problems 45 4 Charge and Energy Transport in a Nondegenerate Electron Gas

Soviet Physics, 1988 **Electronic Properties of Polymers and Related Compounds** H. Kuzmany, M.

Mehring, Siegmund Roth, 2012-12-06 At the International Winter School on Electronic Properties of Polymers and Related Compounds particular attention was paid to a very new and special field in polymer research It is concerned with the study of the electronic structure of polymers and with physical and chemical properties directly related to this structure In particular tutorial and research contributions on electrical electrochemical optical magnetic lattice dynamical and structural properties were presented In addition review reports on related topics such as charge transfer complexes and linear chain compounds transition metal trichalcogenides were included In two discussion meetings the special role of polyacetylene and possible present and future applications of the electronic properties of polymers as e.g. conductors or as electrodes in electrochemical cells were elucidated The electronic properties of polymers cover a wide range of research problems which are of particular interest for polymers with a 1T electron system Thus a great part of the work presented was concerned with conjugated systems Additional presentations dealt with other systems such as biopolymers photopolymers or electrets which are of significant scientific and technical importance It was demonstrated how their electronic properties are increasingly being investigated from a fundamental point of view by applying known concepts of solid state science Electronic Structure and Optical Properties of Semiconductors Marvin L. Cohen, James R. Chelikowsky, 2012-12-06 **High Magnetic Fields in Semiconductor Physics** Gottfried Landwehr, 2012-12-06 High magnetic fields have been an important tool in semiconductor physics for a long time The area has been growing very rapidly since quantum effects in silicon field effect transistors have become of practical interest Since the discovery of the quantum Hall effect by Klaus von Klitzing in 1980 this subject has grown exponentially The book contains 42 invited papers and 37 contributed papers which were presented at the 7th of the traditional Würzburg conferences For the area of high magnetic fields applied in semiconductor physics recent results are discussed and the state of the art is reviewed More than 50% of the papers concern two dimensional electronic systems Other subjects of current interest are magneto optics and magneto transport in three dimensional semiconductors Special attention has been paid to the rapidly growing field of semimagnetic semiconductors *From Hamiltonians to Phase*

Diagrams Jürgen Hafner, 2012-12-06 The development of the modern theory of metals and alloys has coincided with great advances in quantum mechanical many body theory in electronic structure calculations in theories of lattice dynamics and of the configurational thermodynamics of crystals in liquid state theory and in the theory of phase transformations For a long time all these different fields expanded quite independently but now their overlap has become sufficiently large that they are beginning to form the basis of a comprehensive first principles theory of the cohesive structural and thermodynamical properties of metals and alloys in the crystalline as well as in the liquid state Today we can set out from the quantum mechanical many body Hamiltonian of the system of electrons and ions and following the path laid out by generations of theoreticians we can progress far enough to calculate a pressure temperature phase diagram of a metal or a composition temperature phase diagram of a binary alloy by methods which are essentially rigorous and from first principles This book was written with the intention of confronting the materials scientist the metallurgist the physical chemist but also the experimental and theoretical condensed matter physicist with this new and exciting possibility Of course there are limitations to such a vast undertaking as this The selection of the theories and techniques to be discussed as well as the way in which they are presented are necessarily biased by personal inclination and personal expertise Phonons: Theory and Experiments III

Peter Brüesch, 2012-12-06 The first volume of this treatment *Phonons Theory and Experiments I* was devoted to the basic concepts of the physics of phonons and to a study of models for interatomic forces The second volume *Phonons Theory and Experiments II* contains a study of experimental techniques and the interpretation of experimental results In the present third volume we treat a number of phenomena which are directly related to phonons The aim of this book is to bridge the gap between theory and experiment An attempt has been made to present the descriptive as well as the analytical aspects of the topics Although emphasis is placed on the role of phonons in the different topics most chapters also contain a general introduction into the specific subject The book is addressed to experimentalists and to theoreticians working in the vast field of dynamical properties of solids It will also prove useful to graduate students starting research in this or related fields The choice of the topics treated was partly determined by the author's own activity in these areas This is particularly the case for the chapters dealing with phonons in one dimensional metals disordered systems super ionic conductors and certain newer aspects of ferroelectricity and melting I am very grateful to my colleagues J Bernasconi V T Hochli and 1

The Recursion Method and Its Applications D.G. Pettifor, D.L. Weaire, 2012-12-06 This volume reviews recent advances in the development and application of the recursion method in computational solid state physics and elsewhere It comprises the invited papers which were presented at a two day conference at Imperial College London during September 1984 The recursion method is based on the Lanczos algorithm for the tridiagonalisation of matrices but it is much more than a straightforward numerical technique It is widely regarded as the most elegant framework for a variety of calculations into which one may incorporate physical insights and a number of technical devices The standard reference is Volume 35 of *Solid*

State Physics which contains all the early ideas of Heine Haydock and others upon which the method was established The present volume provides the first review of subsequent developments It also indicates where problems remain or opinions differ in the interpretation of the mathematical details or choice of practical techniques in applications The field is still very lively and much remains to be done as the summary chapter clearly demonstrates We are grateful to the SERCS Collaborative Computational Project No 9 on the electronic structure of solids and the Institute of Physics's Solid State Subcommittee for their sponsorship of the conference We thank Angus MacKinnon for his help in conference organisation and Jacyntha Crawley for secretarial assistance December 1984 David G Pettifor Denis L Weaire v Contents Part I Introduction Why Recur By V **Excitonic Processes in Solids** Masayasu Ueta,Hiroshi Kanzaki,Koichi Kobayashi,Yutaka

Toyozawa,Eiichi Hanamura,2012-12-06 An exciton is an electronic excitation wave consisting of an electron hole pair which propagates in a nonmetallic solid Since the pioneering research of Frenkel Wannier and the Pohl group in the 1930s a large number of experimental and theoretical studies have been made Due to these investigations the exciton is now a well established concept and the electronic structure has been clarified in great detail The next subjects for investigation are naturally dynamical processes of excitons such as excitation relaxation annihilation and molecule formation and in fact many interesting phenomena have been disclosed by recent works These excitonic processes have been recognized to be quite important in solid state physics because they involve a number of basic interactions between excitons and other elementary excitations It is the aim of this quasi monograph to describe these excitonic processes from both theoretical and experimental points of view we take a few To discuss and illustrate the excitonic processes in solids important and well investigated insulating crystals as playgrounds for excitons on which they play in a manner characteristic of each material The selection of the materials is made in such a way that they possess some unique properties of excitonic processes and are adequate to cover important interactions in which excitons are involved In each material excitonic processes are described in detail from the experimental side in order to show the whole story of excitons in a particular material **Acta Physica Polonica** ,1986

Elementary Excitations in Quantum Fluids Kohji Ohbayashi,Mitsuo Watabe,2012-12-06 This volume is the proceedings of the Hiroshima Symposium on Elementary Excitations in Quantum Fluids which was held on August 17 and 18 1987 in Hiroshima Japan and was attended by thirty two scientists from seven countries Quantum fluids have been the subject of intense study as a consequence of their superfluid properties at very low temperatures Elementary excitations in them are an important concept about which many important discoveries have been made in recent years This symposium was arranged by a group of physicists from Hiroshima University to provide an opportunity to discuss these recent developments It was conceived as a satellite conference of the 18th International Conference on Low Temperature Physics LT 18 which was held in Kyoto August 20-26 1987 Emphasis was placed on the dynamic structures and correlations of elementary excitations which resulted in invited speakers being selected from this field However enthusiastic contributors reported notable new

results on various other aspects of the elementary excitations which made the symposium lively and successful. It is our great satisfaction to present this volume which includes papers of good quality and originality. We thank all the participants for their cooperation throughout this symposium and for preparing their manuscripts within a reasonable time.

Statistical Physics I Morikazu Toda, Ryōgo Kubo, Ryogo Kubo, N. Saito, Natsuki Hashitsume, 1991. This introduction to the fundamental theories of equilibrium statistical mechanics is self-contained and easily accessible to undergraduate students. Fundamental principles and simple physical examples are particularly emphasized. In preparation. R. Kubo et al. **Statistical Physics II** Springer Series in Solid State Sciences Vol 31. 2nd ed. 1991. ISBN 3 540 53833 X.

The Theory of Magnetism I Daniel C. Mattis, 2012-12-06. Starting with a historical introduction to the study of magnetism, one of the oldest sciences known to man, before considering the most modern theories and observations, magnetic bubbles and soap films, effects of magnetic impurities in metals and spin glasses, this book develops the concepts and the mathematical expertise necessary to understand contemporary research in this field. Magnetic systems are important in technology and applied science, but they are also prototypes of more complex mathematical structures of great importance to theoretical physics. These connections are made repeatedly in this volume. After development of the necessary quantum theory of angular momentum and of interacting electron systems, a number of models which have been successful in the interpretation of experimental results are introduced: the Ising model, the Heisenberg model, the Stoner theory, the Kondo phenomenon, and so on. In the second edition, the thorough approach and the main features which made the first edition a popular text have been retained. All important theories are worked out in detail using methods and notation that are uniform throughout. Footnotes and an extensive bibliography provide a guide to the original literature. A number of problems test the reader's skill.

Core-Level Spectroscopy in Condensed Systems Junjiro Kanamori, Akio Kotani, 2012-12-06. Core-level Spectroscopy in Condensed Systems describes how recent improvement of various experimental methods together with new light and x-ray sources have provided fresh information about the electronic states and atomic structures of a wide variety of materials. The topics covered range from the high-energy spectroscopy of bulk electronic states of rare earth and transition metals and compounds including high-T superconductors to recent developments in photoelectron diffraction and other surface problems, all with emphasis on theoretical aspects.

Dynamical Processes and Ordering on Solid Surfaces A. Yoshimori, M. Tsukada, 2012-12-06. This volume is the proceedings of the Seventh Taniguchi International Symposium on the Theory of Condensed Matter. The symposium was held for five days from September 10 to 14, 1984, at Kashikojima, Mie, Japan. Dynamical processes and ordering on solid surfaces are the subjects of the symposium. About twenty participants stayed together at Shima Kanko Hotel, the symposium site during the period. The intense and productive discussion in the bright sea-side atmosphere of Kashikojima is believed to have been impressive to all the participants. Dynamical processes on solid surfaces are the target of recent theoretical efforts in surface physics. Even if some of them are still in their infant stage,

important aspects begin to appear and vital concepts start to shape themselves. Some topics in the symposium were the energy transfer related with internal degrees of freedom of molecules, attempts to go beyond the trajectory approximation on charge transfer and energy transfer between particles and solid surfaces and related fundamental problems like adiabatic potentials and electronic structures. In particular, really actively discussed was the time dependent Newns Anderson model without and with the intraatomic Coulomb interaction and sometimes with the interaction to the surface plasmons or phonons. Surface effects on the optical processes were discussed with great interest such as the ABC related problems of exciton polaritons and rare gas adsorbates on metal surfaces.

Beyond the Crystalline State Ganesan

Venkataraman, Debendranath Sahoo, Venkataraman Balakrishnan, 2012-12-06 Condensed matter exhibits a rich variety of phases. Of these the crystalline state has until recently received most attention. This is not surprising given the geometric regularity of crystals. At the other extreme one has amorphous materials. In between there are the various types of liquid crystals, the recently discovered quasicrystals and so on. While the absence of the high degree of regularity that characterizes the crystalline phase is certainly a problem, these noncrystalline states have nevertheless been receiving some attention over the years. However, it is only during the last few years that something like a unified view of all these phases has begun to emerge through an application of various sophisticated concepts. Geometry and symmetry and unusual realizations of the latter provide a unifying thread in this new and emerging perspective. This book is an attempt to capture the flavour of some of these recent developments. The approach is substantially descriptive, being intended to be accessible not only to experimental physicists but also to chemists, materials scientists, metallurgists and ceramicists whose work borders on physics. The prerequisites for a study of this book are a familiarity with basic solid state physics and in places the elements of group theory and statistical mechanics. A few special topics are included at the end to aid those who wish to pursue further the subject matter treated here.

The Fractional Quantum Hall Effect Tapash Chakraborty, Pekka

Pietiläinen, 2012-12-06 The experimental discovery of the fractional quantum Hall effect (FQHE) at the end of 1981 by Tsui, Stormer and Gossard was absolutely unexpected since at this time no theoretical work existed that could predict new structures in the magnetotransport coefficients under conditions representing the extreme quantum limit. It is more than thirty years since investigations of bulk semiconductors in very strong magnetic fields were begun. Under these conditions only the lowest Landau level is occupied and the theory predicted a monotonic variation of the resistivity with increasing magnetic field, depending sensitively on the scattering mechanism. However, the experimental data could not be analyzed accurately since magnetic freeze out effects and the transitions from a degenerate to a nondegenerate system complicated the interpretation of the data. For a two dimensional electron gas where the positive background charge is well separated from the two dimensional system, magnetic freeze out effects are barely visible and an analysis of the data in the extreme quantum limit seems to be easier. First measurements in this magnetic field region on silicon field effect transistors were not

successful because the disorder in these devices was so large that all electrons in the lowest Landau level were localized. Consequently models of a spin glass and finally of a Wigner solid were developed and much effort was put into developing the technology for improving the quality of semiconductor materials and devices especially in the field of two dimensional electron systems.

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