

Springer Series in  
**Solid-State Sciences 63**

# **Electronic Properties of Polymers and Related Compounds**

Editors: H. Kuzmany, M. Mehring, and S. Roth



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# Electronic Properties Of Polymers And Related Compounds

**Yuriy Monarkha, Kimitoshi Kono**



## **Electronic Properties Of Polymers And Related Compounds:**

**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  $\pi$  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 Properties of Polymers and Related Compounds. Proceedings of an International Winter School, Kirchberg 1985 , Electronic Properties of Polymers and Related Compounds Hans Kuzmany, M. Mehring, Siegmund Roth, 1985

Principles of Polymer Systems, Sixth Edition Ferdinand Rodriguez, Claude Cohen, Christopher K. Ober, Lynden Archer, 2014-12-09 Maintaining a balance between depth and breadth the Sixth Edition of Principles of Polymer Systems continues to present an integrated approach to polymer science and engineering A classic text in the field the new edition offers a comprehensive exploration of polymers at a level geared toward upper level undergraduates and beginning graduate students Revisions to the sixth edition include A more detailed discussion of crystallization kinetics strain induced crystallization block copolymers liquid crystal polymers and gels New powerful radical polymerization methods Additional polymerization process flow sheets and discussion of the polymerization of polystyrene and poly vinyl chloride New discussions on the elongational viscosity of polymers and coarse grained bead spring molecular and tube models Updated information on models and experimental results of rubber elasticity Expanded sections on fracture of glassy and semicrystalline polymers New sections on fracture of elastomers diffusion in polymers and membrane formation New coverage of polymers from renewable resources New section on X ray methods and dielectric relaxation All chapters have been updated and out of date material removed The text contains more theoretical background for some of the fundamental concepts pertaining to polymer structure and behavior while also providing an up to date discussion of the latest developments in polymerization systems Example problems in the text help students through step by step solutions and nearly 300 end of chapter problems many new to this edition reinforce the concepts presented

**2-mm Wave Band EPR Spectroscopy of Condensed Systems** V. I. Krinichnyi, 2018-01-18 This is the first book to summarize the problems of using modern high resolution 2 mm wave band EPR spectroscopy in an interdisciplinary field for the investigation of various condensed systems The material is well illustrated and the applications are as diverse as possible The main subjects included are unique characteristics of 2 mm EPR spectroscopy and appropriate experimental techniques dynamics and polarity of radical microenvironment in model and biological systems and the nature of charge carriers and charge transfer mechanisms in organic polymer semiconductors Electron Correlations in Molecules and Solids Peter Fulde, 2012-12-06 Quantum chemistry and solid state theory are two important related fields of research that have grown up with almost no cross communication This book bridges the gap between the two In the first half new concepts for treating weak and strong correlations are developed and standard quantum chemical methods as well as density functional Green's function functional integral and Monte Carlo methods are discussed The second half discusses applications of the theory to molecules semiconductors homogeneous metallic systems transition metals and strongly correlated systems such as heavy fermion systems and the new high T<sub>c</sub> superconducting materials *Advances in Electronics and Electron Physics*, 1989-08-23 *Advances in Electronics and Electron Physics* Polymers for Electronic Applications J.H. Lai, 2018-01-18 The object of this book is to review and to discuss some important applications of polymers in electronics The first three chapters discuss the current primary applications of polymers in semiconductor device manufacturing polymers as resist materials for integrated circuit fabrication polyimides as electronics packaging materials and polymers as integrated circuits encapsulates Excitons in Low-Dimensional Semiconductors Stephan Glutsch, 2013-04-17 Low dimensional semiconductors have become a vital part of today's semiconductor physics and excitons in these systems are ideal objects that bring textbook quantum mechanics to life Furthermore their theoretical understanding is important for experiments and optoelectronic devices The author develops the effective mass theory of excitons in low dimensional semiconductors and describes numerical methods for calculating the optical absorption including Coulomb interaction geometry and external fields The theory is applied to Fano resonances in low dimensional semiconductors and the Zener breakdown in superlattices Comparing theoretical results with experiments the book is essentially self contained it is a hands on approach with detailed derivations worked examples illustrative figures and computer programs The book is clearly structured and will be valuable as an advanced level self study or course book for graduate students lecturers and researchers Positron Annihilation in Semiconductors Reinhard Krause-Rehberg, Hartmut S. Leipner, 1999-01-21 This comprehensive book reports on recent investigations of lattice imperfections in semiconductors by means of positron annihilation It reviews positron techniques and describes the application of these techniques to various kinds of defects such as vacancies impurity vacancy complexes and dislocations Statistical Physics II Morikazu Toda, R. Kubo, Nobuhiko Saitō, Natsuki Hashitsume, N. Hashitsume, 1991-11-14 *Statistical Physics II* introduces nonequilibrium theories of statistical mechanics from the viewpoint of the fluctuation

disipation theorem Emphasis is placed on the relaxation from nonequilibrium to equilibrium states the response of a system to an external disturbance and general problems involved in deriving a macroscopic physical process from more basic underlying processes Fundamental concepts and methods are stressed rather than the numerous individual applications

Optics of Semiconductors and Their Nanostructures Heinz Kalt, Michael Hetterich, 2013-04-09 In recent years the field of semiconductor optics has been pushed to several extremes The size of semiconductor structures has shrunk to dimensions of a few nanometers the semiconductor light interaction is studied on timescales as fast as a few femtoseconds and transport properties on a length scale far below the wavelength of light have been revealed These advances were driven by rapid improvements in both semiconductor and optical technologies and were further facilitated by progress in the theoretical description of optical excitations in semiconductors This book written by leading experts in the field provides an up to date introduction to the optics of semiconductors and their nanostructures so as to help the reader understand these exciting new developments It also discusses recently established applications such as blue light emitters as well as the quest for future applications in areas such as spintronics quantum information processing and third generation solar cells

**Statistical Physics I** Morikazu Toda, Ryogo Kubo, Nobuhiko Saito, 2012-12-06 Statistical Physics I discusses the fundamentals of equilibrium statistical mechanics focussing on basic physical aspects No previous knowledge of thermodynamics or the molecular theory of gases is assumed Illustrative examples based on simple materials and photon systems elucidate the central ideas and methods

Magnetism in the Solid State Peter Mohn, 2006-06-09 This book presents a phenomenological approach to the field of solid state magnetism Beginning with basic concepts in statistical thermodynamics and electronic structure theory the text discusses models for localized moments Weiss Heisenberg and delocalized moments Stoner This is followed by a chapter about exchange and correlation in metals again considering the results for the localized and delocalized limit The book ends with a chapter about spin fluctuations which are introduced as an alternative to the finite temperature Stoner theory The book will be a useful reference for researchers and a valuable accompaniment to graduate courses on magnetism and magnetic materials

Magneto-Optics Satoru Sugano, Norimichi Kojima, 2013-03-09 This book is designed to provide graduate students and research beginners with an introductory review of recent developments in the field of microscopic magneto optics The field contains the most important subjects in solid state physics chemical physics and electronic engineering Microscopic studies of magneto optics stem from those of ligand field spectra of paramagnetic ions in solids and liquids which are also well known to have brought developments in material research for solid state lasers As the introductory chapter of this monograph Chap 1 deals with the fundamental properties of ligand field spectra in useful solids Chapter 2 is on elementary excitations such as magnons and excitons in magnetically ordered crystals a central aspect of recent developments in microscopic magneto optics Chapter 3 concerns Raman spectroscopy accompanying magnetic excitations of high energies in strongly correlated electron systems which are related to high T<sub>c</sub> superconductors Chapter 4 is

on recent developments in the studies of non linear optical effects citing experiments for Cr<sup>2+</sup> and describing a microscopic theory for its second harmonic generation In Chap 5 after introducing a phenomenological theory of the Faraday and Kerr effects we present a microscopic theory based on the ligand field theory and discuss the future developments Chapter 6 concerns diluted magnetic semiconductors discussing formation magnetic properties and quantum confinement effects of magnetic polarons Chapter 7 is also on diluted magnetic semiconductors emphasizing the importance in growing new magnetic semiconductors and in studying their remarkable magneto optical properties

**Fractal Concepts in Condensed Matter Physics** Tsuneyoshi Nakayama, Kousuke Yakubo, 2013-06-29 Concisely and clearly written this book provides a self contained introduction to the basic concepts of fractals and demonstrates their use in a range of topics in condensed matter physics and statistical mechanics The first part outlines different fractal structures observed in condensed matter The main part of the book is dedicated to the dynamical behaviour of fractal structures including anomalous and percolating systems The concept of multifractals is illustrated for the metal insulator quantum phase transition The authors emphasize the unified description of these different dynamic problems thus making the book accessible to readers who are new to the field

**X-Ray Multiple-Wave Diffraction** Shih-Lin Chang, 2013-04-17 X ray multiple wave diffraction sometimes called multiple diffraction or N beam diffraction results from the scattering of X rays from periodic two or higher dimensional structures like 2 d and 3 d crystals and even quasi crystals The interaction of the X rays with the periodic arrangement of atoms usually provides structural information about the scatterer Unlike the usual Bragg reflection the so called two wave diffraction the multiply diffracted intensities are sensitive to the phases of the structure factors involved This gives X ray multiple wave diffraction the chance to solve the X ray phase problem On the other hand the condition for generating an X ray multiple wave diffraction is much more strict than in two wave cases This makes X ray multiple wave diffraction a useful technique for precise measurements of crystal lattice constants and the wavelength of radiation sources Recent progress in the application of this particular diffraction technique to surfaces thin films and less ordered systems has demonstrated the diversity and practicability of the technique for structural research in condensed matter physics materials sciences crystallography and X ray optics The first book on this subject Multiple Diffraction of X Rays in Crystals was published in 1984 and intended to give a contemporary review on the fundamental and application aspects of this diffraction

**Two-Dimensional Coulomb Liquids and Solids** Yuriy Monarkha, Kimitoshi Kono, 2013-03-09 This book is about quantum phenomena in two dimensional 2D electron systems with extremely strong internal interactions The central objects of interest are Coulomb liquids in which the average Coulomb interaction energy per electron is much higher than the mean kinetic energy and Wigner solids The main themes are quantum transport in two dimensions and the dynamics of highly correlated electrons in the regime of strong coupling with medium excitations In typical solids the mutual interaction energy of charge carriers is of the same order of magnitude as their kinetic energy and the Fermi liquid approach appears to be

quite satisfactory However in 1970 a broad research began to investigate a remarkable model 2D electron system formed on the free surface of superfluid helium In this system complementary to the 2D electronic systems formed in semiconductor interface structures the ratio of the mean Coulomb energy of electrons to their kinetic energy can reach approximately a hundred before it undergoes the Wigner solid WS transition Under such conditions the Fermi liquid description is doubtful and one needs to introduce alternative treatments Similar interface electron systems form on other cryogenic substrates like neon and solid hydrogen

**Organic Superconductors** Takehiko Ishiguro, Kunihiro Yamaji, Gunzi Saito, 2012-12-06 Organic Superconductors is an introduction to organic conductors and superconductors and a review of the current status of the field First organic conductors are described then the structures and electronic properties of organic superconductors are discussed illustrated with examples of typical compounds The book deals in detail with theories of the mechanism of superconductivity and more briefly with spin density waves The design principle and synthesis of organic superconductors are also described This second edition covers the research activities of the last few years

*Physics of Transition Metal Oxides* Sadamichi Maekawa, Takami Tohyama, Stewart Edward Barnes, Sumio Ishihara, Wataru Koshibae, Giniyat Khaliullin, 2013-03-09 The fact that magnetite Fe<sub>3</sub>O<sub>4</sub> was already known in the Greek era as a peculiar mineral is indicative of the long history of transition metal oxides as useful materials The discovery of high temperature superconductivity in 1986 has renewed interest in transition metal oxides High temperature superconductors are all cuprates Why is it To answer to this question we must understand the electronic states in the cuprates Transition metal oxides are also familiar as magnets They might be found stuck on the door of your kitchen refrigerator Magnetic materials are valuable not only as magnets but as electronics materials Manganites have received special attention recently because of their extremely large magnetoresistance an effect so large that it is called colossal magnetoresistance CMR What is the difference between high temperature superconducting cuprates and CMR manganites Elements with incomplete d shells in the periodic table are called transition elements Among them the following eight elements with the atomic numbers from 22 to 29 i.e. Ti V Cr Mn Fe Co Ni and Cu are the most important These elements make compounds with oxygen and present a variety of properties High temperature superconductivity and CMR are examples Most of the textbooks on magnetism discuss the magnetic properties of transition metal oxides However when one studies magnetism using traditional textbooks one finds that the transport properties are not introduced in the initial stages

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