

Alexander V. Kolobov
Junji Tominaga

Chalcogenides

Metastability and Phase Change
Phenomena

Chalcogenides Metastability And Phase Change Phenomena Springer Series In Materials Science

Keiji Tanaka, Koichi Shimakawa



Chalcogenides Metastability And Phase Change Phenomena Springer Series In Materials Science:

Chalcogenides Alexander V. Kolobov, Junji Tominaga, 2012-08-22 A state of the art description of metastability observed in chalcogenide alloys is presented with the accent on the underlying physics A comparison is made between sulphur selenium based chalcogenide glasses where numerous photo induced phenomena take place entirely within the amorphous phase and tellurides where a reversible crystal to amorphous phase change transformation is a major effect Applications of metastability in devices optical memories and nonvolatile electronic phase change random access memories among others are discussed including the latest trends Background material essential for understanding current research in the field is also provided Springer Handbook of Semiconductor Devices Massimo Rudan, Rossella Brunetti, Susanna Reggiani, 2022-11-10 This Springer Handbook comprehensively covers the topic of semiconductor devices embracing all aspects from theoretical background to fabrication modeling and applications Nearly 100 leading scientists from industry and academia were selected to write the handbook s chapters which were conceived for professionals and practitioners material scientists physicists and electrical engineers working at universities industrial R D and manufacturers Starting from the description of the relevant technological aspects and fabrication steps the handbook proceeds with a section fully devoted to the main conventional semiconductor devices like e g bipolar transistors and MOS capacitors and transistors used in the production of the standard integrated circuits and the corresponding physical models In the subsequent chapters the scaling issues of the semiconductor device technology are addressed followed by the description of novel concept based semiconductor devices The last section illustrates the numerical simulation methods ranging from the fabrication processes to the device performances Each chapter is self contained and refers to related topics treated in other chapters when necessary so that the reader interested in a specific subject can easily identify a personal reading path through the vast contents of the handbook

Two-Dimensional Transition-Metal Dichalcogenides Alexander V. Kolobov, Junji Tominaga, 2016-07-26 This book summarizes the current status of theoretical and experimental progress in 2 dimensional graphene like monolayers and few layers of transition metal dichalcogenides TMDCs Semiconducting monolayer TMDCs due to the presence of a direct gap significantly extend the potential of low dimensional nanomaterials for applications in nanoelectronics and nano optoelectronics as well as flexible nano electronics with unprecedented possibilities to control the gap by external stimuli Strong quantum confinement results in extremely high exciton binding energies which forms an interesting platform for both fundamental studies and device applications Breaking of spatial inversion symmetry in monolayers results in strong spin valley coupling potentially leading to their use in valleytronics Starting with the basic chemistry of transition metals the reader is introduced to the rich field of transition metal dichalcogenides After a chapter on three dimensional crystals and a description of top down and bottom up fabrication methods of few layer and single layer structures the fascinating world of two dimensional TMDCs structures is presented with their unique atomic electronic and magnetic properties The book covers

in detail particular features associated with decreased dimensionality such as stability and phase transitions in monolayers the appearance of a direct gap large binding energy of 2D excitons and trions and their dynamics Raman scattering associated with decreased dimensionality extraordinarily strong light matter interaction layer dependent photoluminescence properties new physics associated with the destruction of the spatial inversion symmetry of the bulk phase spin orbit and spin valley couplings The book concludes with chapters on engineered heterostructures and device applications such as a monolayer MoS₂ transistor Considering the explosive interest in physics and applications of two dimensional materials this book is a valuable source of information for material scientists and engineers working in the field as well as for the graduate students majoring in materials science

Handbook of Solid State Chemistry, 6 Volume Set Richard Dronskowski, Shinichi Kikkawa, Andreas Stein, 2017-10-23 This most comprehensive and unrivaled compendium in the field provides an up to date account of the chemistry of solids nanoparticles and hybrid materials Following a valuable introductory chapter reviewing important synthesis techniques the handbook presents a series of contributions by about 150 international leading experts the Who's Who of solid state science Clearly structured in six volumes it collates the knowledge available on solid state chemistry starting from the synthesis and modern methods of structure determination Understanding and measuring the physical properties of bulk solids and the theoretical basis of modern computational treatments of solids are given ample space as are such modern trends as nanoparticles surface properties and heterogeneous catalysis Emphasis is placed throughout not only on the design and structure of solids but also on practical applications of these novel materials in real chemical situations

World Scientific Reference Of Amorphous Materials, The: Structure, Properties, Modeling And Main Applications (In 3 Volumes), 2020-12-28 Amorphous solids including glassy and non crystalline solids are ubiquitous since the vast majority of solids naturally occurring in our world are amorphous Although the field is diverse and complex this three volume set covers the vast majority of the important concepts needed to understand these materials and their principal practical applications One volume discusses the most important subset of amorphous insulators namely oxide glasses the other two volumes discuss the most important subsets of amorphous semiconductors namely tetrahedrally coordinated amorphous semiconductors and amorphous and glassy chalcogenides Together these three volumes provide a comprehensive set of theoretical concepts and practical information needed to become conversant in the field of amorphous materials They are suitable for advanced graduate students postdoctoral research associates and researchers wishing to change fields or sub fields The topics covered in these three volumes include 1 concepts for understanding the structures of amorphous materials 2 techniques to characterize the structural electronic and optical properties of amorphous materials 3 the roles of defects in affecting the electronic and optical properties of amorphous materials and 4 the concepts for understanding practical devices and other applications of amorphous materials Applications discussed in these volumes include transistors solar cells displays bolometers fibers non volatile memories vidicons photoresists and optical disks

Springer Handbook of Glass J. David Musgraves, Juejun Hu, Laurent Calvez, 2019-11-08 This handbook provides comprehensive treatment of the current state of glass science from the leading experts in the field Opening with an enlightening contribution on the history of glass the volume is then divided into eight parts The first part covers fundamental properties from the current understanding of the thermodynamics of the amorphous state kinetics and linear and nonlinear optical properties through colors photosensitivity and chemical durability The second part provides dedicated chapters on each individual glass type covering traditional systems like silicates and other oxide systems as well as novel hybrid amorphous materials and spin glasses The third part features detailed descriptions of modern characterization techniques for understanding this complex state of matter The fourth part covers modeling from first principles calculations through molecular dynamics simulations and statistical modeling The fifth part presents a range of laboratory and industrial glass processing methods The remaining parts cover a wide and representative range of applications areas from optics and photonics through environment energy architecture and sensing Written by the leading international experts in the field the Springer Handbook of Glass represents an invaluable resource for graduate students through academic and industry researchers working in photonics optoelectronics materials science energy architecture and more

Chalcogenide Xinyu Liu, Sanghoon Lee, Jacek K. Furdyna, Tengfei Luo, Yong Zhang, 2019-11-14 Chalcogenide From 3D to 2D and Beyond reviews graphene like 2D chalcogenide systems that include topological insulators interesting thermoelectric structures and structures that exhibit a host of spin phenomena that are unique to 2D and lower dimensional geometries The book describes state of the art materials in growth and fabrication magnetic electronic and optical characterization as well as the experimental and theoretical aspects of this family of materials Bulk chalcogenides chalcogenide films their heterostructures and low dimensional chalcogenide based quantum structures are discussed Particular attention is paid to findings that are relevant to the continued search for new physical phenomena and new functionalities Finally the book covers the enormous opportunities that have emerged as it has become possible to achieve lower dimensional chalcogenide structures by epitaxial techniques Provides readers with foundational information on the materials growth fabrication magnetic electronic and optical characterization of chalcogenide materials Discusses not only bulk chalcogenides and chalcogenide thin films but also two dimensional chalcogenide materials systems Reviews the most important applications in optoelectronics photovoltaics and thermoelectrics

Semiconductor Metasurfaces, Part 1, 2024-10-25 Semiconductor Metamaterials Part One Volume 116 in a two part series surveys the state of the art in material platforms for optical metasurfaces Chapters cover Metasurfaces from materials with 2nd order nonlinearity Light Emitting Metasurfaces based on Direct Bandgap Semiconductors Tunable Metasurfaces enabled by Phase Change Materials Phase Transition Materials for Thermal Tuning of Metasurfaces Tunable Metasurface Devices based on Soft Matter Infrared Metasurfaces Polarization Sensing Platforms UV Visible Metasurfaces and Metasurfaces for Catalysis Chemistry Provides the most important aspects of the semiconductor

materials platforms that are used for optical metasurfaces Considers both static and dynamic metasurfaces Covers the entire EM spectrum from UV to visible and IR light

Chalcogenide Glasses J-L Adam,X. Zhang,2014-02-14 The unique properties and functionalities of chalcogenide glasses make them promising materials for photonic applications Chalcogenide glasses are transparent from the visible to the near infrared region and can be moulded into lenses or drawn into fibres They have useful commercial applications as components for lenses for infrared cameras and chalcogenide glass fibres and optical components are used in waveguides for use with lasers for optical switching chemical and temperature sensing and phase change memories Chalcogenide glasses comprehensively reviews the latest technological advances in this field and the industrial applications of the technology Part one outlines the preparation methods and properties of chalcogenide glasses including the thermal properties structure and optical properties before going on to discuss mean coordination and topological constraints in chalcogenide network glasses and the photo induced phenomena in chalcogenide glasses This section also covers the ionic conductivity and physical aging of chalcogenide glasses deposition techniques for chalcogenide thin films and transparent chalcogenide glass ceramics Part two explores the applications of chalcogenide glasses Topics discussed include rare earth doped chalcogenide glass for lasers and amplifiers the applications of chalcogenide glasses for infrared sensing microstructured optical fibres for infrared applications and chalcogenide glass waveguide devices for all optical signal processing This section also discusses the control of light on the nanoscale with chalcogenide thin films chalcogenide glass resists for lithography and chalcogenide for phase change optical and electrical memories The book concludes with an overview of chalcogenide glasses as electrolytes for batteries Chalcogenide glasses comprehensively reviews the latest technological advances and applications of chalcogenide glasses and is an essential text for academics materials scientists and electrical engineers working in the photonics and optoelectronics industry Outlines preparation methods and properties and explores applications of chalcogenide glasses Covers the ionic conductivity and physical aging of chalcogenide glasses deposition techniques for chalcogenide thin films and transparent chalcogenide glass ceramics Discusses the control of light on the nanoscale with chalcogenide thin films chalcogenide glass resists for lithography and chalcogenide for phase change optical and electrical memories

Comprehensive Semiconductor Science and Technology ,2011-01-28 Semiconductors are at the heart of modern living Almost everything we do be it work travel communication or entertainment all depend on some feature of semiconductor technology Comprehensive Semiconductor Science and Technology Six Volume Set captures the breadth of this important field and presents it in a single source to the large audience who study make and exploit semiconductors Previous attempts at this achievement have been abbreviated and have omitted important topics Written and Edited by a truly international team of experts this work delivers an objective yet cohesive global review of the semiconductor world The work is divided into three sections The first section is concerned with the fundamental physics of semiconductors showing how the electronic features and the lattice dynamics change

drastically when systems vary from bulk to a low dimensional structure and further to a nanometer size Throughout this section there is an emphasis on the full understanding of the underlying physics The second section deals largely with the transformation of the conceptual framework of solid state physics into devices and systems which require the growth of extremely high purity nearly defect free bulk and epitaxial materials The last section is devoted to exploitation of the knowledge described in the previous sections to highlight the spectrum of devices we see all around us Provides a comprehensive global picture of the semiconductor world Each of the work s three sections presents a complete description of one aspect of the whole Written and Edited by a truly international team of experts

Nanofillers for Binary Polymer Blends Sabu Thomas, Soney C. George, Sharika T. Nair, 2024-06-28 Nanofillers for Binary Polymer Blends covers major advances in the field of polymer blend nanocomposites The book encompasses the fundamentals of polymer blends various nanofillers experimental techniques used in their fabrication the characterization of various polymer blend nanocomposites and theoretical evaluations of various properties The properties and potential applications that have been achieved in various polymer blends by the addition of nanofillers are also highlighted Applications for commercial products including automotive parts packaging construction materials biotechnology medical devices building materials computer housings car interiors etc are also covered in detail This is an important reference source for materials scientists and engineers looking to increase their understanding of how nanofillers are being used in polymer blends Outlines the various types of nanofillers explaining how the properties of each enhances the morphology rheology mechanical dynamic mechanical viscoelastic electrical and thermal properties of polymer blends Provides information on the theory modeling and simulation of nano filled polymer blends Assesses the mechanism of selective localization of nanofillers in polymer blends the effect of localization of nanofillers on the microstructure and the relative performance of polymer blends

Amorphous Chalcogenide Semiconductors and Related Materials Keiji Tanaka, Koichi Shimakawa, 2021-07-01 This book provides introductory comprehensive and concise descriptions of amorphous chalcogenide semiconductors and related materials It includes comparative portraits of the chalcogenide and related materials including amorphous hydrogenated Si oxide and halide glasses and organic polymers It also describes effects of non equilibrium disorder in comparison with those in crystalline semiconductors

Advances in Nanomaterials Mushahid Husain, Zishan Husain Khan, 2016-03-15 This book provides a review of the latest research findings and key applications in the field of nanomaterials The book contains twelve chapters on different aspects of nanomaterials It begins with key fundamental concepts to aid readers new to the discipline of nanomaterials and then moves to the different types of nanomaterials studied The book includes chapters based on the applications of nanomaterials for nano biotechnology and solar energy Overall the book comprises chapters on a variety of topics on nanomaterials from expert authors across the globe This book will appeal to researchers and professional alike and may also be used as a reference for courses in nanomaterials

Phase Change Materials Simone Raoux, Matthias

Wuttig, 2010-06-10 Phase Change Materials Science and Applications provides a unique introduction of this rapidly developing field. Clearly written and well structured, this volume describes the material science of these fascinating materials from a theoretical and experimental perspective. Readers will find an in depth description of their existing and potential applications in optical and solid state storage devices as well as reconfigurable logic applications. Researchers, graduate students and scientists with an interest in this field will find Phase Change Materials to be a valuable reference. *Phase Change Materials* Simone Raoux, Matthias Wuttig, 2010-11-16 Phase Change Materials Science and Applications provides a unique introduction of this rapidly developing field. Clearly written and well structured, this volume describes the material science of these fascinating materials from a theoretical and experimental perspective. Readers will find an in depth description of their existing and potential applications in optical and solid state storage devices as well as reconfigurable logic applications. Researchers, graduate students and scientists with an interest in this field will find Phase Change Materials to be a valuable reference. Pressure-Induced Phase Transitions in AB₂X₄ Chalcogenide Compounds Francisco Javier Manjon, Ion Tiginyanu, Veaceslav Ursaki, 2014-01-21 This book on pressure induced phase transitions in AB₂X₄ chalcogenide compounds deals with one important AmBnXp material. The interest in these materials is caused by their properties. The results are discussed for three main groups of structural families: cubic spinel structures, defective tetragonal structures and other structures like layered and wurtzite type modifications. A systematic analysis of the behavior of cubic spinel, tetragonal defect chalcopyrites and stannites and other crystal modifications of AB₂X₄ compounds under hydrostatic pressure is performed. The behavior of Al_{1.5}Al_{0.5}Se₄, Al_{1.5}Ga_{0.5}Se₄, Al_{1.5}Al_{0.5}Te₄ and Al_{1.5}Ga_{0.5}Te₄ compounds with defective tetragonal structures, compounds with layered and wurtzite structures under hydrostatic pressure and the pressure dependence of the band gap, lattice parameters, interatomic distances, vibrational modes and pressure induced phase transitions is discussed. Many of these compounds, except oxide spinels, undergo a pressure induced phase transition towards the rocksalt type structure. The phase transition is preceded by disorder in the cation sublattice. The dependence of the transition pressure to the rocksalt type structure as a function of the compound ionicity and the size criterion is analyzed. At high pressures, all ordered vacancy compounds are found to exhibit a band anticrossing between several conduction bands that leads to a strong decrease of its pressure coefficient and consequently to a strong non linear pressure dependence of the direct bandgap energy. Theoretical studies of phase transitions in several ordered vacancy compounds reveal that the existence of ordered vacancies alters the cation-anion bond distances and their compressibilities. The book is written for students, Ph.D. students and specialists in materials science, phase transitions and new materials. Disordered Materials Stadford R. Ovshinsky, 2012-12-06 Landmark contributions to science and mechanisms for the origin of the phenomena and technology are rarely recognized at the time of reaching important conclusions about the physical properties of the materials. Few people even in technical areas recognize the importance of developments such as electronic nonequilibrium properties. Many of

these the transistor the laser or electrophotography ideas were condensed into a publication for Physical until well after their successful demonstration Review Letters paper 1 in this collection This So called experts in fact tend to resist new paper immediately attracted attention to the field inventions a natural instinct based on a combina and directly lead to the initiation of large research tion of fear of obsolescent expertise and jealousy efforts at both industrial laboratories and univer arising from lack of active participation in the ties throughout the world Inevitably there was discovery the usual amount of controversy with many experts Denigration of new ideas is a relatively simultaneously taking positions 2 and 3 above safe modus operandi since the vast majority It has now been well over 20 years since eventually are abandoned well short of commerciality the original publication date and an objective view However a successful device can be identified by can be taken in hindsight *Guide to Modeling of Phase Change Phenomena in Chemical and Materials Engineering* Petr A. Nikrityuk,2025-02-26 *Chalcogenide Alloys for Reconfigurable Electronics: Volume 918* P. Craig Taylor,2006-10-11 The MRS Symposium Proceeding series is an internationally recognised reference suitable for researchers and practitioners

Reviewing **Chalcogenides Metastability And Phase Change Phenomena Springer Series In Materials Science:** Unlocking the Spellbinding Force of Linguistics

In a fast-paced world fueled by information and interconnectivity, the spellbinding force of linguistics has acquired newfound prominence. Its capacity to evoke emotions, stimulate contemplation, and stimulate metamorphosis is actually astonishing. Within the pages of "**Chalcogenides Metastability And Phase Change Phenomena Springer Series In Materials Science**," an enthralling opus penned by a very acclaimed wordsmith, readers set about an immersive expedition to unravel the intricate significance of language and its indelible imprint on our lives. Throughout this assessment, we shall delve into the book's central motifs, appraise its distinctive narrative style, and gauge its overarching influence on the minds of its readers.

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