

**OPTOELECTRONIC
PROPERTIES of
SEMICONDUCTORS
and SUPERLATTICES**

M.O. Manasreh, *series editor*

Volume 18

**LEAD CHALCOGENIDES
PHYSICS AND APPLICATIONS**

Edited by

Dmitriy Khokhlov



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Semiconductors Chalcogenides

Keiji Tanaka, Koichi Shimakawa



Semiconductors Chalcogenides:

Applications of Chalcogenides: S, Se, and Te Gurinder Kaur Ahluwalia, 2016-11-02 This book introduces readers to a wide range of applications for elements in Group 16 of the periodic table such as optical fibers for communication and sensing X ray imaging electrochemical sensors data storage devices biomedical applications photovoltaics and IR detectors the rationale for these uses the future scope of their applications and expected improvements to existing technologies Following an introductory section the book is broadly divided into three parts dealing with Sulfur Selenium and Tellurium The sections cover the basic structure of the elements and their compounds in bulk and nanostructured forms properties that make these useful for various applications followed by applications and commercial products As the global technology revolution necessitates the search for new materials and more efficient devices in the electronics and semiconductor industry

Applications of Chalcogenides S Se and Te is an ideal book for a wide range of readers in industry government and academic research facilities looking beyond silicon for materials used in the electronic and optoelectronic industry as well as biomedical applications

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

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

Introduction to Semiconductors Peter Sutter, 2025-08-05 This textbook provides a new perspective on the classic topic of Semiconductor Materials and Devices It aims at undergraduate and beginning graduate students in the physical sciences and in engineering This book combines two unique aspects i Making quantum mechanical concepts broadly accessible Rather than avoiding fundamental concepts such as electronic band structure and phonons as is the case in the established texts on semiconductors the book embraces and incorporates them as key building blocks While conceptually sound and rigorous this textbook avoids unnecessary detail to provide students with a solid understanding of key concepts while enabling rapid progress toward the learning goals ii Extensive examples sourced from contemporary research Advanced topics from the current literature past 10 years are included as natural extensions to each chapter of the book These contemporary examples

broaden the students knowledge beyond the typical content of an introductory textbook provide relevant literature references and encourage further reading and self study In this way the extensions help educate the students for careers in the post silicon era Provides a concise introduction to semiconductor materials and devices accessible to students of varying backgrounds Makes extensive use of current real examples to facilitate understanding and motivate further reading Prepares students for careers in semiconductor research and development device design and manufacturing

Semiconducting Chalcogenide Glass II Robert Fairman, Boris Ushkov, 2004-12-17 Chalcogenide glass is made up of many elements from the Chalcogenide group The glass is transparent to infrared light and is useful as a semiconductor in many electronic devices For example chalcogenide glass fibers are a component of devices used to perform laser surgery The properties of chalcogenide glass result not only from their chemical composition and atomic structure but also from the impact of numerous external factors A comprehensive survey is presented of the properties of chalcogenide glass under various external impacts Practical recommendations are presented for a wide range of applications Part II is the second part of a three volume work within the Semiconductors and Semimetals series The first collective monograph written by Eastern European scientists on the electrical and optical properties of chalcogenide vitreous semiconductors CVS Contributions by B G Kolomiets who discovered the properties of chalcogenide glass in 1955 Provides objective evidence and discussion by authors from opposing positions

Amorphous Chalcogenides Victor I. Mikla, Victor V. Mikla, 2011-09-23 Amorphous chalcogenide semiconductors have commercial value and have many uses such as image formation including x rays and high definition TV pick up tubes They have widespread application in the microelectronics industry and amorphous metallic alloys also have useful magnetic properties This book focuses on their imaging applications and related properties It examines the two groups of amorphous semiconductors that are of most commercial interest 1 the chalcogenide glasses 2 the tetrahedrally bonded amorphous solids such as amorphous silicon germanium and related alloys Both of these groups may be conveniently prepared in the form of thin thick films which is of considerable importance in applications where large area coverage of flat or curved surfaces of rigid or flexible materials is desirable such as in photovoltaic arrays X Ray sensors display screens and photocopier drums Provides information on the amorphous semiconductors that are of most commercial interest Presents the history of the commercial applications the latest developments and future possibilities

Electrochemistry of Metal Chalcogenides Mirtat Bouroushian, 2010-04-23 The author provides a unified account of the electrochemical material science of metal chalcogenide MCh compounds and alloys with regard to their synthesis processing and applications Starting with the chemical fundamentals of the chalcogens and their major compounds the initial part of the book includes a systematic description of the MCh solids on the basis of the Periodic Table in terms of their structures and key properties This is followed by a general discussion on the electrochemistry of chalcogen species and the principles underlying the electrochemical formation of inorganic compounds alloys The core of the book offers an insight into available experimental

results and inferences regarding the electrochemical preparation and microstructural control of conventional and novel MCh structures. It also aims to survey their photoelectrochemistry both from a material oriented point of view and as connected to specific processes such as photocatalysis and solar energy conversion. Finally, the book illustrates the relevance of MCh materials to various applications of electrochemical interest such as electrocatalysis in fuel cells, energy storage with intercalation electrodes and ion sensing.

Metastable States in Amorphous Chalcogenide Semiconductors Victor I. Mikla, Victor V. Mikla, 2009-12-24. This book presents experimental results on the structural and electronic metastable states in Se-rich chalcogenides. Coverage includes states in the mobility gap, structural transformation, photocrystallization, and many potential related applications.

Amorphous Chalcogenide Semiconductors and Related Materials Keiji Tanaka, Koichi Shimakawa, 2011-05-24. Amorphous Chalcogenide Semiconductors and Glasses describes developments in the science and technology of this class of materials. This book offers an up-to-date treatment of chalcogenide glasses and amorphous semiconductors from basic principles to applications while providing the reader with the necessary theoretical background to understanding the material properties.

Chalcogenides form a special class of materials which have one or more of the elements from the chalcogen group (Group VI in the Periodic Table: S, Se, or Te) as a constituent. The chalcogen is mixed with other elements to form various new compounds and alloys. Chalcogenides are noncrystalline solids because their structure is amorphous or glassy. Such structures have totally different properties than crystalline solids. Chalcogenide glasses have a number of very interesting and useful properties which have been already exploited in the commercialization of new devices.

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 the 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.

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. Metal-Chalcogenide Nanocomposites

Mohammad Ehtisham Khan, Jeenat Aslam, 2023-11-19 Metal chalcogenides have exceptional properties and can be used for electronic devices, environmental monitoring and sensing applications for energy storage as electrode materials in fuel cells, membranes, and for photocatalytic degradation of environmental pollutants in the field of waste water treatment applications. Metal Chalcogenide Nanocomposites: Fundamentals, Properties, and Industrial Applications focuses on metal chalcogenide nanomaterials for environmental remediation and corrosion applications. The chapters focus on cost-effective and facile fabrication approaches, their growth mechanisms, optical, electrical, and other important properties, and their applications in a broad range of diverse fields such as photocatalysis, photovoltaics, hydrogen production, lithium batteries, energy storage, anticorrosion, and sensor devices. The book will be an important information source for both material scientists and engineers who want to create the next generation of products and devices for energy and environmental applications. Covers fabrication, standard characterization, photocatalytic mechanisms, and environmentally sustainable fabrication methods. Applications covered include environmental electronics, oil gas water treatment, sensing, and many more. Includes challenges and future opportunities, which are discussed in detail. State-of-the-Art Program on Compound Semiconductors : (SOTAPOCS XLII) and Processes at the Compound-Semiconductor/Solution Interface P. C. Chang, 2005

Semiconductors T. F. Connolly, 2012-12-06 And often on request from the issuing installation. USAEC reports are also available from International Atomic Energy Agency, Kaerntnerring A 1010 Vienna, Austria. National Lending Library, Boston Spa, England. Monographs and reports of the National Bureau of Standards are for sale by Superintendent of Documents, U S Government Printing Office, Washington D C 20402. Theses listed as Dissertation Abstracts number are available in North and South America from University Microfilms, Dissertation Copies, P O Box 1764, Ann Arbor, Michigan 48106 and elsewhere from

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Semiconducting Chalcogenide Glass I Robert Fairman, Boris Ushkov, 2004-05-10 Chalcogenide glass is made up of many elements from the Chalcogenide group The glass is transparent to infrared light and is useful as a semiconductor in many electronic devices For example chalcogenide glass fibers are a component of devices used to perform laser surgery This book is a comprehensive survey of the current state of science and technology in the field of chalcogenide semiconductor glasses While the majority of the book deals with properties of chalcogenide glass chapters also deal with industrial applications synthesis and purification of chalcogenide glass and glass structural modification The first individual or collective monograph written by Eastern European scientists known to Western readers regarding structural and chemical changes in chalcogenide vitreous semiconductors CVS Chapters written by B G Kolomiets who discovered the properties of chalcogenide glass in 1955 Provides evidence and discussion for problems discussed by authors from opposing positions

Recent advances in heavily doped plasmonic copper chalcogenides: from synthesis to biological application Qiulian Mao, Jicun Ma, Mei Chen, Shiyang Lin, Noman Razzaq, Jiabin Cui, 2023-05-26 Copper based chalcogenide compounds have emerged as alternative materials to Cd or Pb based traditional semiconductors and have drawn significant attention Compared with widely reported semiconductors copper chalcogenide nanocrystals NCs with abundant copper defects and vacancies present p type features Additionally the migration of free hole carriers in copper based chalcogenide NCs produced a metal like local surface plasmon resonance LSPR effect In this review we focused on the plasmonic copper chalcogenide NCs achieved through a heavily doped strategy The copper sulfur compounds with versatile atomic ratios and complex crystal structures exhibit rich electrical optical and magnetic properties making them highly promising for a broad range of applications from energy conversion to biomedical fields Therefore our main focus is on the classification of copper chalcogenide synthesis strategies theoretical studies of doping doping strategies and biological applications We aim to analyze the trends of copper based chalcogenide nanomaterials for clinical applications by summarizing previous studies and presenting designs and concepts in a brief manner

Chalcogenide-Based Nanomaterials as Photocatalysts Mohammad Mansoob Khan, 2021-04-07 Chalcogenide Based Nanomaterials as Photocatalysts deals with the different types of chalcogenide based photocatalytic reactions covering the fundamental

concepts of photocatalytic reactions involving chalcogenides for a range of energy and environmental applications Sections focus on nanostructure control synthesis methods activity enhancement strategies environmental applications and perspectives of chalcogenide based nanomaterials The book offers guidelines for designing new chalcogenide based nanoscale photocatalysts at low cost and high efficiency for efficient utilization of solar energy in the areas of energy production and environment remediation Provides information on the development of novel chalcogenide based nanomaterials Outlines the fundamentals of chalcogenides based photocatalysis Includes techniques for heterogeneous catalysis based on chalcogenide based nanomaterials

Band Structure of Semiconductors I. M. Tsidilkovski, 2016-10-19 Band Structure of Semiconductors provides a review of the theoretical and experimental methods of investigating band structure and an analysis of the results of the developments in this field The book presents the problems methods and applications in the study of band structure Topics on the computational methods of band structure band structures of important semiconducting materials behavior of an electron in a perturbed periodic field effective masses and g factors for the most commonly encountered band structures and the treatment of cyclotron resonance Shubnikov de Haas oscillations magnetophonon resonance and magneto optical phenomena are discussed Experimental physicists theoretical physicists students and research workers and engineers working in the field of semiconductor electronics will find this book a great source of vital information

Chalcogenide Abhay Kumar Singh, Tien-Chien Jen, 2021-04-26 This is introductory book for researchers scientists and students in the area of organic and inorganic composite materials This book has addressed timely the innovative topic chalcogenide multiwalled carbon nanotubes and chalcogenide bilayer graphene composite materials under a glassy regime This book will give a clear idea on the concepts of the newly established composite materials area by providing interpretations of inside physio chemical mechanism The remarkable landmark innovations related to this newly introduced research field are included in this book Additionally the possible futuristic applications in the area of nanoelectronics optoelectronics biomedical etc are also addressed

Lead Chalcogenides D. Khokhlov, 2002-11-15 Lead Chalcogenides remain one of the basic materials of modern infrared optoelectronics This volume presents the properties of lead chalcogenides including the basic physical features the bulk and epitaxial growth technique and the 2 D physics of lead chalcogenide based structures In addition the theoretical approaches for band structure and impurity state calculations are reviewed

Unveiling the Magic of Words: A Report on "**Semiconductors Chalcogenides**"

In a world defined by information and interconnectivity, the enchanting power of words has acquired unparalleled significance. Their ability to kindle emotions, provoke contemplation, and ignite transformative change is really awe-inspiring. Enter the realm of "**Semiconductors Chalcogenides**," a mesmerizing literary masterpiece penned by way of a distinguished author, guiding readers on a profound journey to unravel the secrets and potential hidden within every word. In this critique, we shall delve to the book is central themes, examine its distinctive writing style, and assess its profound affect the souls of its readers.

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Table of Contents Semiconductors Chalcogenides

1. Understanding the eBook Semiconductors Chalcogenides
 - The Rise of Digital Reading Semiconductors Chalcogenides
 - Advantages of eBooks Over Traditional Books
2. Identifying Semiconductors Chalcogenides
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Semiconductors Chalcogenides
 - User-Friendly Interface
4. Exploring eBook Recommendations from Semiconductors Chalcogenides
 - Personalized Recommendations
 - Semiconductors Chalcogenides User Reviews and Ratings
 - Semiconductors Chalcogenides and Bestseller Lists

5. Accessing Semiconductors Chalcogenides Free and Paid eBooks
 - Semiconductors Chalcogenides Public Domain eBooks
 - Semiconductors Chalcogenides eBook Subscription Services
 - Semiconductors Chalcogenides Budget-Friendly Options
6. Navigating Semiconductors Chalcogenides eBook Formats
 - ePub, PDF, MOBI, and More
 - Semiconductors Chalcogenides Compatibility with Devices
 - Semiconductors Chalcogenides Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Semiconductors Chalcogenides
 - Highlighting and Note-Taking Semiconductors Chalcogenides
 - Interactive Elements Semiconductors Chalcogenides
8. Staying Engaged with Semiconductors Chalcogenides
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Semiconductors Chalcogenides
9. Balancing eBooks and Physical Books Semiconductors Chalcogenides
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Semiconductors Chalcogenides
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Semiconductors Chalcogenides
 - Setting Reading Goals Semiconductors Chalcogenides
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Semiconductors Chalcogenides
 - Fact-Checking eBook Content of Semiconductors Chalcogenides
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
- Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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