

Principles Of Electronic Materials And Devices

Electronic Materials Principles of Electronic Materials and Devices Electronic Materials Electronic Materials Reliability and Failure of Electronic Materials and Devices Handbook of Electronic Materials Electronic Materials Principles of Electronic Materials and Devices Handbook of Electronic Materials: Electronic properties of composite materials Electronic Materials Corrosion and Reliability of Electronic Materials and Devices Introduction to the Electronic Properties of Materials Introduction to Electronic Materials and Devices Physics of Electronic Materials Handbook of Electronic Materials Modern Electronic Materials Electronic Materials Electronic Materials From Basics to Advanced Electronic Materials and Engineering for Students Micro- and Opto-Electronic Materials and Structures: Physics, Mechanics, Design, Reliability, Packaging H.L. Kwok Safa O. Kasap L.A.A. Warnes L. S. Miller Milton Ohring James R Chelikowsky Safa O. Kasap Nicholas Braithwaite Robert B. Comizzoli David Jiles Sergio M. Rezende J rgen Rammer M. Neuberger John B. Watkins Yuriy M. Poplavko James R. Chelikowsky Annika Ephraim Suhir

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*Comizzoli David Jiles Sergio M. Rezende J rgen Rammer M. Neuberger John B. Watkins
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volume is indexed by thomson reuters bci was the electronic properties of solids have become of increasing importance in the age of information technology the study of solids and materials while having originated from the disciplines of physics and chemistry has evolved independently over the past few decades the classical treatment of solid state physics which emphasized classifications theories and fundamental physical principles is no longer able to bridge the gap between materials advances and applications in particular the more recent developments in device physics and technology have not necessarily been driven by new concepts in physics or new materials but rather by the ability of engineers to control crystal structures and properties better via advances in crystal growth and patterning techniques in many cases new applications simply arise from the adaption of conventional ideas to interdisciplinary areas one example is that of recent advances which rely heavily upon the availability of the sub micron technology developed by the semiconductor industry another example is the emergence of nanotechnology

the new edition of this popular text presents introductory coverage of electronic materials and devices for undergraduate courses in materials science and engineering electrical engineering and physics with the additional topics in the text and selected articles from the cd rom it can also be used in a graduate introductory course in electronic materials or for self study it has been written with ample flexibility to allow sections and chapters to be skipped as desired by the instructor for both short and long courses cross referencing has been minimized the third edition includes new topics and extended sections such as diffusion conduction in thin films interconnects in microelectronics electromigration stefan s radiation law field emission from carbon nanotubes piezoresistivity amorphous semiconductors solar cells leds debye relaxation giant magnetoresistance magnetic data storage reststrahlen absorption luminescence and white leds and x ray diffraction appendix it also has a large number of new worked examples numerous new homework problems and many new illustrations and photographs this text is one of the few books in the market that has the broad coverage of electronic materials and devices that today s scientists and

engineers need book jacket

the importance of materials science for the progress of electronic technology has been apparent to all since the invention of the transistor in 1948 though that epoch making event was the result of far sighted research planning by bell laboratories dating from a decade or more before no mere chance discovery therefore but the fruition of work which allotted at its inception a vital role to materials the transistor is now very old hat but new materials developments are continually triggering fresh developments in electronics from optical communications to high temperature superconductors electronic engineers are now given at least two courses in materials as part of their degree programme this book arose from a series of forty lectures the author gave to the third year students on the extended honours degree course in electronic and electrical engineering at loughborough university though additional elementary material has been included to make the book suitable for first year students the biggest problem in such a course is deciding what must be left out and this i am afraid i shirked by leaving out all those areas which i was not familiar with from my days in the ministry of aviation the semiconductor device industry and as a graduate student and research worker i hope that what remains is sufficiently catholic

with one or two exceptions the materials dealt with are all active materials those involved in the processing of signals in a way that depends crucially on some specific property of those materials the types of signals considered include optical as well as electronic functions and also chemical s

reliability and failure of electronic materials and devices is a well established and well regarded reference work offering unique single source coverage of most major topics related to the performance and failure of materials used in electronic devices and electronics packaging with a focus on statistically predicting failure and product yields this book can help the design engineer manufacturing engineer and quality control engineer all better understand the common mechanisms that lead to electronics materials failures including dielectric breakdown hot electron effects and radiation damage this new edition adds cutting edge knowledge gained both in research labs and on the manufacturing floor with new sections on plastics and other new packaging materials new testing procedures and new

coverage of mems devices covers all major types of electronics materials degradation and their causes including dielectric breakdown hot electron effects electrostatic discharge corrosion and failure of contacts and solder joints new updated sections on failure physics on mass transport induced failure in copper and low k dielectrics and on reliability of lead free reduced lead solder connections new chapter on testing procedures sample handling and sample selection and experimental design coverage of new packaging materials including plastics and composites

principles of electronic materials and devices second edition is a greatly enhanced version of the highly successful text principles of electrical engineering materials and devices it is designed for a first course on electronic materials given in electrical engineering materials science and engineering and physics departments at the undergraduate level the second edition has numerous revisions additional sections such as phonons and optoelectronic materials and devices more solved problems and a completely new chapter on optical properties of materials the revisions have improved the rigor without sacrificing the original semiquantitative approach that the students liked for example the thermoelectric effect now includes the mott jones index α which is normally treated at the graduate level but has been introduced here through a semiquantitative discussion to explain the true sign of the seebeck coefficient in metals one of the most difficult graduate topics in quantum mechanics of metals the problems have also been updated and various difficult figures have been redrafted to enhance the pedagogy the second edition includes the electronic materials and devices cd rom the cd includes color overhead transparency diagrams that can be printed by instructors and students on any color printer an illustrated dictionary of electronic materials and devices numerous selected topics and solved problems the text with its selected topics can also serve as a first course in materials science aimed at electrical engineers and engineering physics students it is suitable for both one and two semester courses by focusing only on those topics relevant to materials that make up electronic and optoelectronic devices the book offers students a deeper and more meaningful discussion of this material than is offered in general materials science textbooks the coverage is up to date and the applications are of special relevance to students of electronics materials science and engineering physics the solutions manual for the second edition is available

from the publisher the mcgraw hill website and also from the author s website at electronicmaterials.usask.ca

a text about materials which are used for their electrical and magnetic properties rather than their mechanical properties assuming a working knowledge of basic scientific technological and materials ideas many of the consequences of the behaviour of electrons within the material are explained

the subject of electronics and in particular the electronic properties of materials is one which has experienced unprecedented growth in the last thirty years the discovery of the transistor and the subsequent development of integrated circuits has enabled us to manipulate and control the electronic properties of materials to such an extent that the entire telecommunications and computer industries are dependent on the electronic properties of a few semiconducting materials the subject area is now so important that no modern physics materials science or electrical engineering degree programme can be considered complete without a significant lecture course in electronic materials ultimately the course requirements of these three groups of students may be quite different but at the initial stages of the discussion of electronic properties of materials the course requirements are broadly identical for each of these groups furthermore as the subject continues to grow in importance the initial teaching of this vital subject needs to occur earlier in the curriculum in order to give the students sufficient time later to cover the increasing amount of material

this textbook lays out the fundamentals of electronic materials and devices on a level that is accessible to undergraduate engineering students with no prior coursework in electromagnetism and modern physics the initial chapters present the basic concepts of waves and quantum mechanics emphasizing the underlying physical concepts behind the properties of materials and the basic principles of device operation subsequent chapters focus on the fundamentals of electrons in materials covering basic physical properties and conduction mechanisms in semiconductors and their use in diodes transistors and integrated circuits the book also deals with a broader range of modern topics including magnetic spintronic and superconducting materials and devices optoelectronic and photonic devices as well as the light emitting diode solar cells and various types of lasers the last

chapter presents a variety of materials with specific novel applications such as dielectric materials used in electronics and photonics liquid crystals and organic conductors used in video displays and superconducting devices for quantum computing clearly written with compelling illustrations and chapter end problems rezende s introduction to electronic materials and devices is the ideal accompaniment to any undergraduate program in electrical and computer engineering adjacent students specializing in physics or materials science will also benefit from the timely and extensive discussion of the advanced devices materials and applications that round out this engaging and approachable textbook

this report was prepared by hughes aircraft company culver city california under contract number f33615 70 c 1348 the work was administered under the direction of the air force materials laboratory air force systems command wright patterson air force base ohio with mr b emrich project engineer the electronic properties information center epic is a designated information analysis center of the department of defense authorized to provide information to the entire dod community the purpose of the center is to provide a highly competent source of information and data on the electronic optical and magnetic properties of materials of value to the department of defense its major function is to evaluate compile and publish the experimental data from the world s unclassified literature concerned with the properties of materials all materials relevant to the field of electronics are within the scope of epic insulators semiconductors metals super conductors ferrites ferroelectrics ferromagnetics electroluminescents thermionic emitters and optical materials the center s scope includes information on over 100 basic properties of materials information generally regarded as being in the area of devices and or circuitry is excluded grateful acknowledgement is made for the review and comments by dr victor rehn of the u s naval ordnance test station at china lake california as well as for review by staff members of the national bureau of standards national standard data reference system v contents introduction composite data table 5 diamond 6 bibliography 11 germanium 14 bibliography 28 silicon 36 bibliography

modern electronic materials focuses on the development of electronic components the book first discusses the history of electronic components including early developments up to 1900 developments up to world war ii post war developments and a comparison of present

microelectric techniques the text takes a look at resistive materials topics include resistor requirements basic properties evaporated film resistors thick film resistors and special resistors the text examines dielectric materials considerations include basic properties evaporated dielectric materials ceramic dielectrics metallization process vacuum tightness and materials with large values of permittivity the text also discusses the reliability of discrete electronic components the book also explains magnetic materials focus is on basic properties preparation of ferrite materials magnetization curve and microwave properties of ferrite materials the text is a valuable reference for readers interested in electronic materials

mechanical and thermal properties are reviewed and electrical and magnetic properties are emphasized basics of symmetry and internal structure of crystals and the main properties of metals dielectrics semiconductors and magnetic materials are discussed the theory and modern experimental data are presented as well as the specifications of materials that are necessary for practical application in electronics the modern state of research in nanophysics of metals magnetic materials dielectrics and semiconductors is taken into account with particular attention to the influence of structure on the physical properties of nano materials the book uses simplified mathematical treatment of theories while emphasis is placed on the basic concepts of physical phenomena in electronic materials most chapters are devoted to the advanced scientific and technological problems of electronic materials in addition some new insights into theoretical facts relevant to technical devices are presented electronic materials is an essential reference for newcomers to the field of electronics providing a fundamental understanding of important basic and advanced concepts in electronic materials science provides important overview of the fundamentals of electronic materials properties significant for device applications along with advanced and applied concepts essential to those working in the field of electronics takes a simplified and mathematical approach to theories essential to the understanding of electronic materials and summarizes important takeaways at the end of each chapter interweaves modern experimental data and research in topics such as nanophysics nanomaterials and dielectrics

modern materials science is exploiting novel tools of solid state physics and chemistry to obtain an unprecedented understanding of the structure of matter at the atomic level the

direct outcome of this understanding is the ability to design and fabricate new materials whose properties are tailored to a given device application although applications of materials science can range from low weight high strength composites for the automobile and aviation industry to biocompatible polymers in no other field has progress been more strikingly rapid than in that of electronic materials in this area it is now possible to predict from first principles the properties of hypothetical materials and to construct artificially structured materials with layer by layer control of composition and microstructure the resulting superlattices multiple quantum wells and high temperature superconductors among others will dominate our technological future a large fraction of the current undergraduate and graduate students in science and engineering will be directly involved in furthering the revolution in electronic materials with this book we want to welcome such students to electronic materials research and provide them with an introduction to this exciting and rapidly developing area of study a second purpose of this volume is to provide experts in other fields of solid state physics and chemistry with an overview of contemporary research within the field of electronic materials

in the vast realm of technology electronic materials play a crucial role in shaping our modern world from the smallest microprocessors to the largest power grids electronic materials are the foundation of countless devices and systems that drive our society forward in this subchapter we will delve into the definition and importance of electronic materials providing students in the field of materials science and engineering with a comprehensive understanding of this fascinating subject electronic materials can be broadly defined as substances that possess properties conducive to the flow of electric current these materials exhibit a wide range of electrical behaviors such as conductivity resistance and insulating properties which make them invaluable in the design and development of electronic devices from semiconductors like silicon and germanium to conductors like copper and aluminum electronic materials come in various forms each with its unique set of properties and applications the importance of electronic materials in the field of materials science and engineering cannot be overstated these materials are the building blocks of electronic devices enabling the conversion storage and transmission of electrical energy they are essential in the production of integrated circuits transistors solar cells batteries sensors and

countless other electronic components that power our daily lives understanding the properties behavior and fabrication methods of electronic materials is fundamental for students pursuing a career in this field moreover the study of electronic materials is crucial for advancing technology and driving innovation as the demand for faster smaller more efficient and environmentally sustainable electronic devices continues to grow researchers and engineers need to explore new materials and improve existing ones by understanding the properties and behaviors of electronic materials students can contribute to the development of cutting edge technologies such as flexible electronics wearable devices renewable energy systems and quantum computing

this handbook provides the most comprehensive up to date and easy to apply information on the physics mechanics reliability and packaging of micro and opto electronic materials it details their assemblies structures and systems and each chapter contains a summary of the state of the art in a particular field the book provides practical recommendations on how to apply current knowledge and technology to design and manufacture it further describes how to operate a viable reliable and cost effective electronic component or photonic device and how to make such a device into a successful commercial product

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