Wide Band Gap Semiconductor Nanowires For Optical Devices

Wide Band Gap Semiconductor Nanowires 2Oxide Nanowires for Sensing, Photonics and PhotovoltaicsFundamentals of Micro-OpticsSemiconductor NanowiresOptical Resonances of Semiconductor NanowiresNanoscience in Food and Agriculture 4Computational NanophotonicsSilicon Nanomaterials SourcebookNanofabricationElectronic and Optical Properties of Silicon NanowiresWide Band Gap Semiconductor Nanowires 1UV-VIS and Photoluminescence Spectroscopy for Nanomaterials CharacterizationSurface Optical Modes in Semiconductor NanowiresMagnetic Assembly of NanowiresSemiconductor NanowiresManufacturing Science and Technology, AEMT2011Nanowires and NanobeltsPhotonic Applications in Nonlinear Optics, Nanophotonics, and Microwave PhotonicsAdvanced Engineering Forum Vol.382003 Conference on Lasers and Electro-Optics Europe Vincent Consonni Matthew David Law Hans Zappe J Arbiol Linyou Cao Shivendu Ranjan Sarhan Musa Klaus D. Sattler Ampere A. Tseng Daryoush Shiri Vincent Consonni Challa S.S.R. Kumar Prasana Sahoo Carlos Maldonado Hangarter Brian Piccione Peng Cheng Wang Zhong Lin Wang Roberto A. Morandotti Takashi Minegishi Conference on Lasers and Electro-optics Europe

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this book the second of two volumes describes heterostructures and optoelectronic devices made from gan and zno nanowires over the last decade the number of publications on gan and zno nanowires has grown exponentially in particular for their potential optical applications in leds lasers uv detectors or solar cells so far such applications are still in their infancy which we analyze as being mostly due to a lack of understanding and control of the growth of nanowires and related heterostructures furthermore dealing with two different but related semiconductors such as zno and gan but also with different chemical and physical synthesis methods will bring valuable comparisons in order to gain a general approach for the growth of wide band gap nanowires applied to optical devices

from optical fundamentals to advanced applications this comprehensive guide to micro optics covers all the key areas for those who need an in depth introduction to micro optic devices technologies and applications topics covered range from basic optics optical materials refraction and diffraction to micro mirrors micro lenses diffractive optics optoelectronics and fabrication advanced topics such as tunable and nano optics are also discussed real world case studies and numerous worked examples are provided throughout making complex concepts easier to follow whilst an extensive bibliography provides a valuable resource for further study with exercises provided at the end of each chapter to aid and test understanding this is an ideal textbook for graduate and advanced undergraduate students taking courses in optics photonics micro optics microsystems and mems it is also a useful self study guide for research engineers working on optics development

semiconductor nanowires promise to provide the building blocks for a new generation of nanoscale electronic and optoelectronic devices semiconductor nanowires materials synthesis characterization and applications covers advanced materials for nanowires the growth and synthesis of semiconductor nanowires including methods such as solution growth movpe mbe and self organization characterizing the properties of semiconductor nanowires is covered in chapters describing studies using tem spm and raman scattering applications of semiconductor nanowires are discussed in chapters focusing on solar cells battery electrodes sensors optoelectronics and biology explores a selection of advanced materials for semiconductor nanowires outlines key techniques for the

property assessment and characterization of semiconductor nanowires covers a broad range of applications across a number of fields

semiconductor nanowires are one of the most exciting frontiers of materials research due to their potential applications in a wide range of important fields including information technology biomedicine sustainable energy and artificial intelligence embarking on these exciting applications heavily hinges on deep understanding of fundamental properties of the nanowires for the first time we experimentally demonstrate the general existence of strong tunable optical resonances in semiconductor nanowires and propose a theoretical model leaky mode resonances lmrs that provides an intuitive understanding of the optical resonances the optical resonances enable to engineer light absorption scattering and emission of the nanowires for the rational design of high performance optoelectronic devices including photodetectors solar cells and light emitters more interestingly coupled optical resonances in a complex nanowire structure can give rise to many novel optical functionalities that do not exist in stand alone nanowires for example coupled nanowire optical waveguiding physically the optical resonances arise from strong and resonant coupling of light with leaky modes supported by the nanowires when the light wavelength matches one of the allowed lmrs the high refractive index wire can capture and trap the light by multiple internal reflections at its boundary and build up strong electromagnetic field inside as a consequence the photoresponses of the nanowire at the specific wavelength or wavelength bands including absorption scattering and emission can be dramatically enhanced by tuning the nw diameter both the number of allowed lmrs in the nanowire and the spectral position of specific lmrs can be precisely controlled this size dependent tunability provides a powerful guidance for the rational design of photonic devices with desired spectral polarization response features the technological promise of this approach is illustrated in efficient germanium photodetectors in near infrared regime silicon solar cells with 250 enhancement in solar absorption efficiency and multicolored silicon nanostructures optical coupling between neighboring nanowires provides extra latitudes to manipulate light at the nanoscale the essence of the optical coupling lies in the exchange of photons between the nanowires much like the exchange of electrons between neighboring atoms in molecules experimentally it can be observed by monitoring the light scattering spectra of a bi nanowire structure that consists of two nanowires with similar diameter and parallel to each other by taking into account the leaky nature of optical modes in the nanowire resonator we propose a theoretical model coupled leaky mode theory clmt to account for the experimental observations and to point towards rational designs of

complex nanostructures with desirable light matter interaction features for nanophotonic applications such as efficient transfer of optical power at the nanoscale through a chain of coupled nanowires overall these results represent the first systematic studies of optical resonances of semiconductor nanowires the demonstrated general existence of the lmrs and the coupled lmrs cast new light on semiconductor nanostructures and open up enormous opportunities to explore novel optical and optoelectronic funtionalities in semiconductor nanostructures for photonics applications

in this book we present ten chapters describing the synthesis and application of nanomaterials for health food agriculture and bioremediation nanomaterials with unique properties are now being used to improve food and agricultural production research on nanomaterials is indeed revealing new applications that were once thought to be imaginary specifically applications lead to higher crop productivity with nanofertilisers better packaging longer food shelf life and better sensing of aromas and contaminants these applications are needed in particular in poor countries where food is scarce and the water quality bad nanotechnology also addresses the age old issue of water polluted by industrial urban and agricultural pollutants for instance research produces nanomaterials that clean water more efficiently than classical methods thus yielding water for drinking and irrigation however some nanomaterials have been found to be toxic therefore nanomaterials should be engineered to be safe for the environment

this reference offers tools for engineers scientists biologists and others working with the computational techniques of nanophotonics it introduces the key concepts of computational methods in a manner that is easily digestible for newcomers to the field the book also examines future applications of nanophotonics in the technical industry and covers new developments and interdisciplinary research in engineering science and medicine it provides an overview of the key computational nanophotonics and describes the technologies with an emphasis on how they work and their key benefits

this comprehensive tutorial guide to silicon nanomaterials spans from fundamental properties growth mechanisms and processing of nanosilicon to electronic device energy conversion and storage biomedical and environmental applications it also presents core knowledge with basic mathematical equations tables and graphs in order to provide the reader with the tools necessary to understand the latest technology developments from low dimensional structures quantum dots and nanowires to hybrid

materials arrays networks and biomedical applications this sourcebook is a complete resource for anyone working with this materials covers fundamental concepts properties methods and practical applications focuses on one important type of silicon nanomaterial in every chapter discusses formation properties and applications for each material written in a tutorial style with basic equations and fundamentals included in an extended introduction highlights materials that show exceptional properties as well as strong prospects for future applications klaus d sattler is professor physics at the university of hawaii honolulu having earned his phd at the swiss federal institute of technology eth in zurich he was honored with the walter schottky prize from the german physical society and is the editor of the sister work also published by taylor francis carbon nanomaterials sourcebook as well as the acclaimed multi volume handbook of nanophysics

many of the devices and systems used in modern industry are becoming progressively smaller and have reached the nanoscale domain nanofabrication aims at building nanoscale structures which can act as components devices or systems in large quantities at potentially low cost nanofabrication is vital to all nanotechnology fields especially for the realization of nanotechnology that involves the traditional areas across engineering and science this is the first book solely dedicated to the manufacturing technology in nanoscale structures devices and systems and is designed to satisfy the growing demands of researchers professionals and graduate students both conventional and non conventional fabrication technologies are introduced with emphasis on multidisciplinary principles methodologies and practical applications while conventional technologies consider the emerging techniques developed for next generation lithography non conventional techniques include scanning probe microscopy lithography self assembly and imprint lithography as well as techniques specifically developed for making carbon tubes and molecular circuits and devices sample chapter s chapter 1 atom molecule and nanocluster manipulations for nanostructure fabrication using scanning probe microscopy 3 320 kb contents atomic force microscope lithography n kawasegi et al nanowire assembly and integration z gu d h gracias extreme ultraviolet lithography h kinoshita electron projection lithography t miura et al electron beam direct writing k yamazaki electron beam induced deposition k mitsuishi focused ion beams and interaction with solids t ishitani et al nanofabrication of nanoelectromechanical systems nems emerging techniques k l ekinci j brugger and other papers readership researchers professionals and graduate students in the fields of nanoengineering and nanoscience

gan and zno nanowires can by grown using a wide variety of methods from physical vapor deposition to wet chemistry for optical devices this book starts by presenting the similarities and differences between gan and zno materials as well as the assets and current limitations of nanowires for their use in optical devices including feasibility and perspectives it then focuses on the nucleation and growth mechanisms of zno and gan nanowires grown by various chemical and physical methods finally it describes the formation of nanowire heterostructures applied to optical devices

second volume of a 40 volume series on nanoscience and nanotechnology edited by the renowned scientist challa s s r kumar this handbook gives a comprehensive overview about uv visible and photoluminescence spectroscopy for the characterization of nanomaterials modern applications and state of the art techniques are covered and make this volume essential reading for research scientists in academia and industry in the related fields

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volume 1 metal and semiconductor nanowires covers a wide range of materials systems from noble metals such as au ag cu single element semiconductors such as si and ge compound semiconductors such as inp cds and gaas as well as heterostructures nitrides such as gan and si3n4 to carbides such as sic the objective of this volume is to cover the synthesis properties and device applications of nanowires based on metal and semiconductor materials the volume starts with a review on novel electronic and optical nanodevices nanosensors and logic circuits that have been built using individual nanowires as building blocks then the theoretical background for electrical properties and mechanical properties of nanowires is given the molecular nanowires their quantized conductance and metallic nanowires synthesized by chemical technique will be introduced next finally the volume covers the synthesis and properties of semiconductor and nitrides nanowires

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