Optical And Structural Characterization Of Thin Films

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Optical and Structural Characterization of Natural NanostructuresOptical and Structural Characterization of GaN Based Hybrid Structures and NanorodsLinköping University Electronic Press
Synthesis, Structural Characterization and Non-linear Optical Properties of Side-chain Liquid Crystalline Polymers Springer Science & Business Media
A quantum dot molecule-based Terahertz emitter allows the engineering of intraband transitions and leads to reduced absorption losses. A background of the growth mechanisms for the dots, the background and application of quantum dot molecules (QDMs), optical and structural characterization methods employed in quantum dot research, and the theoretical advantages of III-V quantum dots are discussed in this thesis. A study of the structural and optical properties of In 0.3 Ga 0.7 As/GaAs QDMs formed by two layers of self-assembled, vertically stacked quantum dots is presented. Structural parameters, as determined from transmission electron microscopy studies were used to calculate the strain. The calculated strain field was subsequently used to determine the electronic bandstructure. The theoretically calculated electronic bandstructures were found to be in good agreement with those experimentally measured by using the time integrated photoluminescence technique. In order to understand the QDM properties excitation and temperature dependent photoluminescence studies were conducted.
Synthesis, Optical and Structural Characterization, and Exciton Dynamics of Doped ZnSe Nanocrystals, And, Simultaneous X-ray Emission Spectroscopy of Two Elements Using Energy Dispersive Spectrometer Imperial College Press
The optical and structural properties of high N-content GaAs[subscript0.949]N[subscript0.051] layer and GaAs[subscript0.950]N[subscript0.050]GaAs multiple quantum wells (MQWs) grown on GaAs (001) substrates by metaorganic vapor phase epitaxy (MOVPE) were characterized by photoluminescence (PL) to measure the energy positions of the near band edge excitionic emission, high-resolution X-ray diffraction (HRXRD) and Raman scattering to examine the lattice parameters and the N concentrations of the layers annealed at 650[degrees Celsius] with different annealing time. The post-growth thermal annealing affects an increasing of N concentration, a strain relaxation and a blue-shift of the PL peak energy. After annealing can be explained by two major effects: (i) the reorganization of N and (ii) the strain relaxation in the GaAsN layer. On the other hand, the GaAs[subscript0.950]N[subscript0.050]/GaAs MQWs exhibits exhibits strong PL emission around the 1.3 mum-wavelegth region without post-growth thermal annealing treatment, which suggests an efficient electron confinement in the QWs. After post-growth thermal annealing, blue-shift of PL peak energy was clearly observed. However, this PL blue-shift which is induced by thermal annealing, can be described by diffusion of N atoms out of the well and homogeneity of the N concentration fluctuation. Based on PL results, it is evident that the band alignment of GaAsN/GaAs heterostructure is a type-I band lineup. Adding N to GaAs mainly affects the conduction band (CB) states leading to a large conduction band offset ([triangle]Ec ~ 550 meV). Our results show the potential for the fabrication of 1.3 um-wavelength GaAsN QW lasers on GaAs substrates.
synthesis and structural characterization : Dissertation Linköping University Electronic Press
Structure of silicon carbide wafers have been evaluated by x-ray topography, high resolution x-ray diffraction, etching, Atomic Force Microscopy, and related techniques. The low angle grain boundaries were imaged by White Beam Synchrotron X-Ray Topography and mis-orientations quantitatively mapped out by x-ray diffraction. The dominant component of mis-orientation was basal plane tilt. The formation mechanism is most likely due to buckling of the rigidly mounted SiC seed during initial stages of growth. The morphology of hexagonal voids was studied by optical microscopy and AFM. Voids originate at the seed crystal/crucible lid interface and move through the boule during growth. Interaction of void and grown in dislocations leads to formation of dislocation arrays and open core screw dislocations underneath the void. It appears to be the dominant formation mechanism of micropipes.
Optical and Structural Characterization of GaN Based Hybrid Structures and Nanorods John Wiley & Sons
Polyoxometalates (POMs), a class of molecularly defined transition metal-oxide clusters (TM= Cr, V, Mo, W, Nb), have been developed due to their properties in the field of catalysis, magnetism, electronics, gas sensor, supramolecular chemistry and drug deliver. Among all POMs, tungsten oxide (WOx), as a nontoxic and photostable semiconductor with a narrow bandgap about 2.6 eV, is the most attractive cluster for the researchers. Due to the narrow bandgap of WOx, only the blue and near ultraviolet regions of the solar spectrum can be excited. The photocatalytic performance of WOx can be increased by doping numerous elements to reduce bandgap effectively. POMs offer the advantage of precisely placed atoms and well-defined W:O ratios. Besides, POMs can be used as building blocks for frameworks in which the POMs are linked with all-inorganic linkers. All-inorganic frameworks have high stability, high catalytic activity, photochemical and electrochemical activity. Here, we develop a strategy to synthesize six frameworks based on the Preyssler cluster [P5W30O110]15- linked with various transition metals such as Mn, Fe, Co, Ni, Cu and Zn. Besides, bimetallic POM frameworks have been prepared where the transition metals are distributed homogeneously within all crystals of the sample. In addition, the transition metal ratio was varied from 0 to 1, affording materials with absorption that varies as a function of metal identity and content. The diffuse reflectance from single metallic POM frameworks to bimetallic POM frameworks were shown to illustrate the tunable optical properties of these POM frameworks.
Structural Characterization and Optical Properties of Group IV Semiconductor Alloys CreateSpace
In this work, thin-film deposition of FePc particles nucleated and grown in gels was carried out in air by spin coating. The surface morphology and structure of these films were analysed by scanning electron microscopy (SEM) and Fourier transform infrared (FTIR) spectroscopy. The optical parameters have been investigated using spectrophotometric measurements of transmittance in the wavelength range of 200-1100 nm. The absorption spectra recorded in the UV-Vis region for the deposited samples showed a single band, namely the B or Soret band in the region between 285 and 305 nm. The dependence of the Tauc and Cody optical gaps associated with the thickness of the film was determined and found to be around 4.2 eV from direct transitions and 3.8 eV from non-direct transitions. The films' electric properties and their dependence in the presence of radiation of several wavelengths were evaluated. At lower voltages, ohmic conduction is evident, while space-charge limited conductivity (SCLC) governed by an exponential trap distribution is to be found at higher voltages.
Optical and Structural Characterization of Natural NanostructuresOptical and Structural Characterization of GaN Based Hybrid Structures and Nanorods
In conclusion the structural andl optical characterisation of GaN:In epilayers have shown that only a small amount ofin is incorporated into the Ga sites making the layers to be considered as not pure isoelectronically doped. The In atoms presumably occupy interstitial positions in the crystal lattice concentrate on mosaic grain boundaries and have a tendency to form clusters. The In nucleation near structural defects, like e.g. nano-pits. may recover the lattice structure. increasing the integral PL intensity. Besides. like at conventional isoelectronic doping, local strains induced by the inhomogeneous In distribution may activate mechanisms of structure improvement. On the other hand. the possible occupation of interstitials by the In atoms can hardly be considered as a positive factor.
Synthesis, Properties & Applications Springer Nature
The multielectron catalytic reactions often involve multimetallic clusters, where the reaction is

controlled by the electronic and spin coupling between metals and ligands to facilitate charge transfer, bond formation/breaking, substrate binding, and release of products. A method was developed to detect X-ray emission signal from multiple elements simultaneously to probe the electronic structure and sequential chemistry that occurs between the elements. A wavelength dispersive spectrometer based on the von-Hamos geometry was used, that disperses Kbeta emission signals of multiple elements onto an area detector, and enables an XES spectrum to be measured in a single-shot mode. This overcomes the scanning needs of the Rowland circle spectrometers, and the data is free from temporal and normalization errors, and therefore ideal to follow sequential chemistry at multiple sites. This method was applied to MnOx based electrocatalysts, and the effect of Ni addition was investigated. Electro-deposited Mn oxide catalyses oxygen-evolution reaction (OER) and oxygen-reduction reaction (ORR) at different electrochemical potentials under alkaline condition. Incorporation of Ni reduced the low valent Mn component resulting in higher average oxidation state of Mn in MnNiOx under ORR and OER conditions, when compared to MnO x under similar conditions. The reversibility of the electrocatalyst was also found to improve by the inclusion of Ni.

Non-Linear Optical Materials Springer Science & Business Media

The research described in this dissertation has involved the use of transmission electron microcopy (TEM) to characterize the structural properties of II-VI and III-V compound semiconductor heterostructures and superlattices. The microstructure of thick ZnTe epilayers (~2.4 m) grown by molecular beam epitaxy (MBE) under virtually identical conditions on GaSb, InAs, InP and GaAs (100) substrates were compared using TEM. High-resolution electron micrographs revealed a highly coherent interface for the ZnTe/GaSb sample, and showed extensive areas with well-separated interfacial misfit dislocations for the ZnTe/InAs sample. Lomer edge dislocations and 60o dislocations were commonly observed at the interfaces of the ZnTe/InP and ZnTe/GaAs samples. The amount of residual strain at the interfaces was estimated to be 0.01% for the ZnTe/InP sample and -0.09% for the ZnTe/GaAs sample. Strong PL spectra for all ZnTe samples were observed from 80 to 300 K. High quality GaSb grown by MBE on ZnTe/GaSb (001) virtual substrates with a temperature ramp at the beginning of the GaSb growth has been demonstrated. High-resolution X-ray diffraction (XRD) showed clear Pendellösung thickness fringes from both GaSb and ZnTe epilayers. Cross-section TEM images showed excellent crystallinity and smooth morphology for both ZnTe/GaSb and GaSb/ZnTe interfaces. Plan-view TEM image revealed the presence of Lomer dislocations at the interfaces and threading dislocations in the top GaSb layer. The defect density was estimated to be ~1 x107/cm2. The PL spectra showed improved optical properties when using the GaSb transition layer grown on ZnTe with a temperature ramp. The structural properties of strain-balanced InAs/InAs1-xSbx SLs grown on GaSb (001) substrates by metalorganic chemical vapor deposition (MOCVD) and MBE, have been studied using XRD and TEM. Excellent structural quality of the InAs/InAs1-xSbx SLs grown by MOCVD has been demonstrated. Well-defined ordered-alloy structures within individual InAs1-xSbx layers were observed for samples grown by modulated MBE. However, the ordering disappeared when defects propagating through the SL layers appeared during growth. For samples grown by conventional MBE, high-resolution images revealed that interfaces for InAs1-xSbx grown on InAs layers were sharper than for InAs grown on InAs1-xSbx layers, most likely due to a Sb surfactant segregation effect.

Optical and Structural Characterization of Amorphous Carbon Films Materials Research Forum LLC

Microstructural characterization is usually achieved by allowingsome form of probe to interact with a carefully prepared specimen.The most commonly used probes are visible light, X-ray radiation, ahigh-energy electron beam, or a sharp, flexible needle. These fourtypes of probe form the basis for optical microscopy, X-raydiffraction, electron microscopy, and scanning probemicroscopy. Microstructural Characterization of Materials, 2nd Editionis an introduction to the expertise involved in assessing themicrostructure of engineering materials and to the experimentalmethods used for this purpose. Similar to the first edition, this2nd edition explores the methodology of materials characterizationunder the three headings of crystal structure, microstructuralmorphology, and microanalysis. The principal methods ofcharacterization, including diffraction analysis, opticalmicroscopy, electron microscopy, and chemical microanalyticaltechniques are treated both qualitatively and quantitatively. Anadditional chapter has been added to the new edition to coversurface probe microscopy, and there are new sections on digitalimage recording and analysis, orientation imaging microscopy,focused ion-beam instruments, atom-probe microscopy, and 3-D imagereconstruction. As well as being fully updated, this second editionalso includes revised and expanded examples and exercises, with asolutions manual available athttp://develop.wiley.co.uk/microstructural2e/ Microstructural Characterization of Materials, 2nd Editionwill appeal to senior undergraduate and graduate students ofmaterial science, materials engineering, and materials chemistry,as well as to qualified engineers and more advanced researchers,who will find the book a useful and comprehensive generalreference source.

Preparation and Structural Characterization of Metallophthalocyanine Particles Embedded in a Polymer Matrix ProQuest

This important book focuses on the synthesis and fabrication of nanostructures and nanomaterials, but also includes properties and applications of nanostructures and nanomaterials, particularly inorganic nanomaterials. It provides balanced and comprehensive coverage of the fundamentals and processing techniques with regard to synthesis, characterization, properties, and applications of nanostructures and nanomaterials. Both chemical processing and lithographic techniques are presented in a systematic and coherent manner for the synthesis and fabrication of 0-D, 1-D, and 2-D nanostructures, as well as special nanomaterials such as carbon nanotubes and ordered mesoporous oxides. The book will serve as a general introduction to nanomaterials and nanotechnology for teaching and self-study purposes.

Structural Characterization of Lithium Niobate Nanoparticles Prepared by the Sol-Gel Process, Using X-Ray and Raman Spectroscopy and Scanning Electron Microscopy World Scientific

This book reviews the progress achieved in SiC research and development, particularly over the past 10 years. It presents the essential properties of 3C-, 6H- and 4H-SiC polytypes including structural, electrical, optical, surface and interface properties; describes existing key SiC devices and also the challenges in materials growth and device fabrication of the 21st century.

Electrical Breakdown and Structural Characterization in Synthetic Resins Using Optical Techniques

These proceedings review the progress in most aspects of semiconductor physics, including those related to materials, processing and devices. The conference continues the tradition of the ICPS series and these volumes include state-of-the-art lectures. The plenary and invited papers address areas of major interest.These volumes will serve as excellent material for researchers in semiconductor physics and related fields.

Solar Energy Update

This thesis focuses on structural characterizations and optical properties of Si, Ge based semiconductor alloys. Two material systems are characterized: Si-based III-V/IV alloys, which represent a possible pathway to augment the optical performance of elemental silicon as a solar cell absorber layer, and Ge-based Ge1-ySny and Ge1-x-y Six Sny systems which are applicable to long wavelength optoelectronics. Electron microscopy is the primary tool used to study structural properties. Electron Energy Loss spectroscopy (EELS), Ellipsometry, Photoluminescence and Raman Spectroscopy are combined to investigate electronic band structures and bonding properties. The experiments are closely coupled with structural and property modeling and theory. A series of III-V-IV alloys have been synthesized by the reaction of M(SiH3)3 (M = P, As) with Al atoms from a Knudsen cell. In the AlPSi3 system, bonding configurations and elemental distributions are characterized by scanning transmission electron microscopy (STEM)/EELS and correlated with bulk optical behavior.

Magneto-optical, Chemical and Structural Characterization

This work uses a broad range of optical spectroscopies and electron microscopy to characterize the structure and electronic states of nanowires. We place an emphasis on understanding how to alter the electronic properties using strain and quantum confinement. We seek to develop a comprehensive understanding of NW properties through comparisons with model predictions. In addition, we adapt optical techniques traditionally used with larger structures to obtain a sub-micron measurement of nanowire diffusion and mobility. First, we extend our optical techniques by spatially resolving the diffusion of excitons along the long axis of a nanowire using a solid immersion lens (SIL). By sampling the time decays as a function of distance along the nanowire, we can measure the diffusion of excitons directly. The extracted diffusion constants for defect free single crystal GaAs measured between 45-100 cm^2/s with resultant mobilities of 52,000-116,000 cm^2/eV s. In contrast, a mixed phase InP nanowire shows a much shorter spatial diffusion limited by defect states with measured diffusion constants of 22 cm^2/s and mobilities of 29,000 cm^2/eV s. Turning our focus novel NW morphologies in Chapter 3-5, we first study the strain effects from a series of a lattice mismatched (3.6%) GaAs/GaP core shell NWs. Strain on a semiconductor creates deformations in the lattice of the material which in turn effect the electronic states and possibly the material quality. We compare our PL energies with theoretical predictions and find that our measurements are lower than predicted. We next exploit correlations between PL emission and TO2 phonon emission to predict the hydrostatic and sheer strains in cases when the light hole emission is not visible and/or TO1 phonon cannot be resolved. In chapter 4, we investigate the material quality issues with these strained nanowires and find that the presence of dislocations results in non-radiative recombination centers which causes the electron-hole lifetimes to fall below the system response (

The Chemical Structure of Solids

This book presents high-quality research papers that demonstrate how emerging technologies in the field of intelligent systems can be used to effectively meet global needs. The respective papers highlight a wealth of innovations and experimental results, while also addressing proven IT governance, standards and practices, and new designs and tools that facilitate rapid information flows to the user. The book is divided into five major sections, namely: “Advances in High Performance Computing”, “Advances in Machine and Deep Learning”, “Advances in Networking and Communication”, “Advances in Circuits and Systems in Computing” and “Advances in Control and Soft Computing”.

Structural Characterization of II-VI and III-V Compound Semiconductor Heterostructures and Superlattices

Zn ion implanted silica with controlled thermal annealing was investigated. Low temperature optical measurements indicate presence of Zn cluster in as-implanted silica. Optical spectra of the annealed sample under a reducing environment suggest Zn cluster and Zn metal colloid formation. The absorption peak at 5.3 eV may be due to surface plasma absorption of Zn metal colloids in silica. Oxidized samples (10 and 6x1016 ions/cm2) show an absorption peak at 4.3 and 4.8 eV, respectively, and imply ZnO quantum dot formation. The blueshift in exciton absorption can be attributed to quantum confinement effects.

Optical and Structural Characterization of GaAsN Thin Film and GaAsN/GaAs Multiquantum Well with High Nitrogen Concentration Grown by MOVPE

Colloidal semiconductor nanocrystals or quantum dots have attracted much attention recently with their unique optical properties. Here we present a novel approach to synthesize ZnTe/ZnSe core/shell tunable quantum dots. Characterizations such as transmission electron microscopy, wavelength dispersive X-ray spectroscopy, powder x-ray diffraction are employed to give evidence for the core/shell structure. Absorption, and photoluminescence spectra demonstrate the tunability of this ZnTe/ZnSe core/shell system, and fluorescence lifetime decays suggest a core/shell structure is made.

Structural Characterization of Optical Coatings by Raman Spectroscopy

A fundamental study of the correlations between ion energy, substrate temperature, and plasma density with hydrogen content, percent sp2 bonding, optical gap, and refractive index of hydrogenated amorphous carbon (a-C) films is presented. A strong dependency between the ion energy used during deposition and the film's microstructure is shown. Moreover, it is revealed that the optical properties of the a-C films are controlled by the concentration and size of sp2 clusters in the film.Through N2 mixing in the source gas, room-temperature nitrogen doped polymeric-like a-C films were demonstrated for the first time. X-ray Photoelectron Spectroscopy revealed an increase in the Fermi level of these films with increased nitrogen content.A proof-of-concept a-C based transparent heat mirror (THM) was demonstrated. It was shown that a-C acts as an oxygen-free protective barrier and anti-reflective coating for Ag films in the THM, increasing the transmission in the visible region by 10-20%.

Electrochromic Nickel-tungsten Oxides

Polymer thin film technology has made tremendous advances in the last decade because of the wide range of their technological applications including coatings, adhesives, lithography, organic light emitting diodes, sensors such as electronic noses and organic photodiodes. These applications require polymers to meet diverse performance criteria that range from adhesives to electronic, optical and mechanical performance. For organic light emitting diode applications the electronic and optical properties of the polymer are important whereas for thin film coatings and lubrication applications, structural stability, viscosity and other mechanical properties are critical. The present dissertation entitled, "POLYMER FILM CHARACTERIZATION-Electrical, Optical and Structural Characterization of Li Doped PVC Polymer Electrolyte Films for Battery Application" contains five chapters with the following contents. Films of pure PVC and LiClO4 complexed PVC were prepared by solution cast technique, in various compositions. X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR) and SEM data were recorded on these films to confirm the complexation of salt with the polymer. Conductivity as a function of composition and temperature was studied and the results are explained in terms of existing theories. Optical absorption spectra of these polymer electrolytes were recorded in the wavelength range 200-600 nm and the parameters like optical bandgap (both direct and indirect) and band edge values were determined. To study the charge transport and cell discharge characteristics Wagner's polarization technique was used.