Sociedad Mexicana de Ciencia de Superficies y Vacío A.C.

XXI Congreso Nacional

1 al 5 de Octubre
Mazatlán, Sinaloa
México 2001

RESÚMENES
Book of Abstracts

Welcome

On behalf of the Organizing Committee of the **XXI National Congress** of the ***Sociedad Mexicana de Ciencia de Superficies y Vacío A.C.*** (***SMCSyV***, *Mexican Vacuum and Surface Science Society*) we would like to welcome and to wish you a fruitful week framed by the beautiful beaches of Mazatlán City.

As you will appreciate in the program we have maintained the traditional structure of our Congress: invited speakers, poster contributions, short courses and discussion forums. We tried to bring speakers from all the institutions in México working in the fields of interest to the ***SMCSyV***. Unfortunately the schedule was too tight and it was not possible to include all the colleagues we would like to invite. There are scheduled more than 200 contributions, 24 invited lectures, three short courses, and two discussion forums. Although not included in the program we also allocated some space for small meetings related with specific themes .
We have done our best effort to organize a program that allows you to know about recent developments, exchange ideas, and propitiate a close interaction between colleagues, which could result into new collaborations.

We are grateful to our sponsors whose financial support made possible this event, and to the members of the organizing committee for their dedicated work. The names of the sponsors and committee members are listed in the next pages.

A great part of the work related to this congress was performed at **Cinvestav-IPN** in the facilities of the **Physics Department**; we would like to thank this strong support. Also, we want to express our special thanks for the superb work of our staff: Diana García, Alejandra García, Elizabeth López, Margarita Escobosa, Joel Cruz, Francisco López and Gorgonio Cerón. Finally we acknowledge the great job done by the President of the Local Committee Dr. Castulo A. Alejo Armenta.

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Sociedad Mexicana de Ciencia de Superficies y Vacío A.C.
XXI Congreso Nacional

Programa

Horario	Lunes Monday Octubre 1	Martes Tuesday Octubre 2	Miércoles Wednesday Octubre 3	Jueves Thursday Octubre 4	Viernes Friday Octubre 5
7:00-8:15	Registro		Excursión Turística		
8:15-9:00	Inauguración				
9:00-9:40	H. Navarro	P. Holloway		J. Rickards	J. Martínez-Duart
9:40-10:00	C. A. Alejo-Armenta	R.Brundle		M. Jergel	D.R. Acosta
10:00-10:20	A. Torres			J. Valenzuela-Benavides	M. E. Rodríguez
10:20-10:40	G. Hernández C.	D. Castner		F. Pérez Rodríguez	I. Hernández
10:40-11:00	M. López R.				
11:00-11:20	**Receso**	**Receso**		**Receso**	**Receso**
11:20-12:00	Curso Corto I / Grupo de Trabajo 1	Curso Corto II / Grupo de Trabajo 3		Curso Corto III / Grupo de Trabajo 5	M.C. Asensio
12:00-12:40					G. McGuire
12:40-13:20					L.E. Regalado
13:20-14:00					R. Messier
14:00-16:00	**Comida**	**Mesa redonda A**		**Comida**	**Mesa Redonda B**
16:00-16:40	Curso Corto I / Grupo de Trabajo 2	Curso Corto II / Grupo de Trabajo 4		Curso Corto III / Grupo de Trabajo 6	Arturo Escobosa
6:40-17:00					R. Ramírez
17:00-17:20					V.H. Méndez
17:20-18:00					J. Green
19:00-20:00	Cóctel de Bienvenida	**Sesión de Carteles I**		**Sesión de Carteles II**	Asamblea
20:00-21:00					Cena

Mazatlán, Sinaloa, México
Octubre 1 al 5, 2001

Platicas Invitadas
Invited Talks

Sesión de Carteles I
Posters' Session I
Martes 2 de Octubre

PDI: Películas Delgadas I
RECI: Recubrimientos I
POL: Polímeros
SEMI: Semiconductores I
CMI: Caracterización de Materiales I
MS: Magnetismo y Superconductividad
DIEI: Dieléctricos I
BIO: Biomateriales

Sesión de Carteles II
Posters' Session II
Jueves 4 de Octubre

PDII: Películas Delgadas I
RECII: Recubrimientos II
CIS: Ciencia e Ingeniería de Superficies
SEMII: Semiconductores II
CMII: Caracterización de Materiales II
EI: Electrónica e Instrumentación
DIEII: Dieléctricos II
NANO: Nanoestructuras

Cursos Cortos
Short Courses

Sociedad Mexicana de Ciencia de Superficies y Vacío A. C.

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México, 2001

PLATICAS INVITADAS
INVITED TALKS

INV.1

Influence of Growth Direction on Order-Disorder Transition in $(GaAs)_{1-x}(Si_2)_x$ and $(GaAs)_{1-x}(Ge)_{2x}$:Alloys

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$(GaAs)_{1-x}(Ge)_{2x}$ metastable alloys were epitaxially grown on (001), (111), (112) and (113) GaAs by rf magnetron sputtering. Additionally, $(GaAs)_{1-x}(Si_2)_x$ metastable alloys were epitaxially grown on (001), (111), (110) and (112) GaAs. Single crystal alloys were obtained for Si concentrations in the range $0 =< x =< 0.43$. At higher concentrations the Si segregated. A different long range order parameter behavior with Ge and Si concentration is observed for each growth direction. This provides direct evidence that growth direction affects the long range order disorder transition exhibited by these alloys. The epitaxial growth of these alloys was modeled by a Monte Carlo simulation. The good agreement between the experimental and modeled long range order parameter evidences that atomic ordering in these alloys is ruled mainly by growth direction and not by thermodynamic factors. On the other hand, measurements of the optical gap and Raman scattering in Ge, show that the optical properties are governed by near neighbor correlations and therefore by their short range order. Hence, the substrate orientation and the long range order have negligible effect on the optical properties.

INV.2

Low Temperature Photoreflectance Studies of AlGaAsSb/GaSb Heterostructures

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AlGaAsSb quaternary semiconductor layers are of great interest because their important application as the confining layers in the double heterostructure system AlGaAsSb/InGaAsSb/AlGaAsSb used for the fabrication of semiconductor lasers emitting in the medium infrared (1.6-3.7microns). The characterization of the layer crystalline quality is fundamental for these applications. Using the liquid phase epitaxy (LPE) technique, AlGaAsSb epitaxial layers were grown on GaSb substrates at temperatures around 530 C. Two types of samples were grown: one with an Al concentration of 5% where there is a direct bandgap; and the other one with an Al concentration of 27% where an indirect bandgap semiconductor is obtained. The low temperature photoreflectance (PR) technique was used in order to study the optical properties of the AlGaAsSb/GaSb heterostructures for the two aluminum concentrations used. From the fitting of the theoretical lineshape to the experimental spectra, the fundamental direct bandgap, Eo, and the broadening parameter, G, were determined as a function of the temperature in the range 15-320K. For low temperatures, Eo has a Varshni-type behavior, and from the fitting to the Varshni equation we determine the respective parameters for these type of quaternary materials. The behavior of the G parameter as a function of temperature changes drastically when the aluminum concentration in the layer increases from 5% to 27% and it can be an indication of phonon participation in the optical transitions for the samples with higher aluminum contents.

INV.3

Algunas Aplicaciones de a-Si:H y sus Aleaciones

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Los semiconductores amorfos obtenidos mediante la técnica de PECVD ofrecen alta versatilidad al controlarse las propiedades de estos mediante variación de las condiciones de deposito. De esta manera es posible fabricar materiales hechos a la mediada para aplicaciones específicas. Así por ejemplo a-Si:H y sus aleaciones con Ge, C, y N ofrecen entre otras ventajas una variación gradual del ancho de banda óptico e índice de refracción. Los dispositivos fabricados en estos materiales se consideran una tecnología emergente con nuevas aplicaciones tanto en óptica como en electrónica.
Debido a la compatibilidad de las técnicas de deposito del a-Si:H y sus aleaciones con el proceso de fabricación de circuitos integrados en base de silicio, estos materiales han sido usados para el desarrollo de detectores con aplicaciones en comunicaciones mediante fibras ópticas, detectores de infrarrojo cercano, transistores bipolares de heterounión y bolómetros de película delgada. En el presente trabajo se muestran algunos resultados obtenidos en el laboratorio de Microelectrónica del INAOE.

INV.4

Cálculos de Primeros Principios de la Energía Total de la Reconstrucción Inducida por Al en la Superficie Si(001)-(4x3)*

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Estudios experimentales con el microscopio de barrido por tunelamiento de electrones (STM) han demostrado que la superficie Si(001) se reconstruye de diferentes formas cuando se le deposita un metal del grupo III de la tabla periódica. A temperaturas bajas y concentraciones pequeñas de recubrimiento, la superficie se reconstruye formándose líneas de dímeros del metal adsorbido en la dirección perpendicular a la fila de dímeros de Si. En contraste, a temperaturas altas y recubrimientos pequeños, las líneas de dímeros ya no se forman, en su lugar aparecen subunidades del metal que se deposita, la periodicidad cambia de (2x1) a (4x3). En este trabajo describiremos estudios de primeros principios de la reconstrucción de la superficie Si(001)-(4x3) inducida por Al cuando el metal se deposita a altas temperaturas. Mostraremos como el modelo de Bunk explica los resultados experimetales de Zhu et. al. de la estructura atómica. Para fines de comparación, consideraremos también los modelos de Zotov et. al. y Zhu et. al. Comentaremos la reconstrucción cuando el metal se deposita a bajas temperaturas. Además mostraremos imágenes calculadas de STM para el modelo de Bunk.
*: Trabajo financiado por CONACYT, proyectos 33587 y 26363

INV.5

Manipulating Atoms with Light and its Application in Metrology

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In recent years, production of cold-atoms ensembles by magneto-optical trapping has become a widely used technique in spectroscopy, in atom interferometry, and metrology. In metrology cold atoms production provides an advanced technique to measure the hyperfine levels of the ground state of the Cs-133 atoms by vertical launching atoms while maintaining low temperatures, as low as $3x10^{-6}$ K over absolute zero, allowing the realization of the so called atomic fountain frequency standards and so providing a way to measure, with extremely high accuracy, the energy difference of the hyperfine levels of the ground state of the Cs-133 atoms. With this ultra high resolution spectroscopy is possible to reproduce the definition of the time unit of the International System (SI), the second, with an accuracy of few parts in 10^{16}. In this work we present a brief review of the development of the atomic clocks and we focus on the manipulation of the Cs-133 atoms with light an its application on the reproduction of the time unit, the second, of the SI. We review the mechanisms of the interaction photon-atoms that allows the control of the atom´s internal and external degrees of freedom involved in the Cs-133 cooling. Finally we present the progress done in Mexico at the Centro Nacional de Metrología (CENAM) in the design, construction, and operation of atomic clocks using atoms manipulation with light.

INV.6

Improved Brightness and Efficiency in ZnS:Mn Electroluminescent Sputter Deposited Thin Films by Codoping with KCl

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The mechanisms leading to improved brightness, efficiency, and stability of alternating-current thin-film electroluminescent (ACTFEL) ZnS:Mn phosphors have been studied. Ex-situ co-doping of the sputter deposited ZnS:Mn active layer with K and Cl results in a 53% improvement in brightness, a 62 % improvement in efficiency, and better 100-hour accelerated aging stability. These improvements result from a 75% increase in excitation efficiency for conduction electrons, combined with a small decrease in both light outcoupling and non-radiative recombination efficiencies in the electroluminescent films. Electrical properties data show a reduced amount of static space charge in the do-doped films, resulting in a larger average field, increased excitation efficiency, and increased charge multiplication. The reduced space charge is attributed to the addition of charge compensating zinc vacancy-chlorine complexes and isolated chlorine point defects, which are acceptor and donor defects, respectively, and the reduction of zinc vacancy deep hole traps. It is postulated that higher average fields result in so much higher injected charge from electron multiplication or donor ionization that EL excitation is limited by the phosphor resistance rather than capacitance or density of states. The possibility of using these mechanisms to increase the efficiency of generic ACTFEL phosphors will be discussed.

INV.7

Challenges for Small Defect Characterization During Wafer Processing

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Applied Materials,
Santa Clara

There is often confusion as to how the wafer processing industry uses the terms defect detection, review, classification and characterization, so their meanings and inter-relations are briefly reviewed. Defect Characterization implies analysis in sufficient depth to establish the nature of the defect and root cause. This often involves close collaboration between the analyst and the engineer (Process/Defect/Yield) "owning" the problem.
For particle defects, the first, and all-important, challenge is to quickly and reliably re-find any defect identified as such by defect detection, even down to very small sizes (sub 0.1um). Requirements for achieving this are discussed. The second challenge is composition and morphology determination by SEM/EDX. With correct protocols (which will depend on circumstance) it is often possible to determine composition sufficiently well to determine what the particle is (eg. Al_2O_3, not "contains Al and O") and establish root cause, even down to the 0.2um range. Sometimes SEM/EDX is insufficient, either because chemistry/phase information is also needed (eg. hydrocarbon, graphite, or diamond, not just "carbon"), or because the particle is too small or too thin for EDX. Then it is necessary to move to more sophisticated techniques capable of giving chemistry information and/or of handling very small or very thin situations.
Examples, drawn from a range of hardware issues and processes (CVD, etch, CMP, etc.), largely during hardware/process development through to alpha and beta exit of the tool/process, are given. They fall into the classes of a) where SEM/EDX (done at the expert level) is necessary and sufficient to establish root cause, and b) where one or more of the techniques of SEM/FIB/EDX, micro-Raman, SAM, SIMS, or AFM are also needed. All work involves analytical instrumentation handling full 300mm wafers, with the exception of SIMS.

INV.8

Proteins, Biomaterials and Surface Analysis

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The adsorption of proteins onto a biomaterial surface from the surrounding fluid phase is rapid, with the surface properties of the biomaterial determining the type, amount, orientation and conformation of the adsorbed proteins. The composition of the adsorbed protein layer (i.e., the type and concentration of the proteins present in the adsorbed film) can differ from the fluid phase composition and can change with time adsorbed. For example, the initial composition of the protein film formed upon exposure of a biomaterial to blood plasma is typically enriched fibrinogen. With increasing exposure time, the fibrinogen concentration in the adsorbed film decreases as it is displaced by the other proteins from the blood plasma. In addition to the time-dependent compositional changes, each absorbed protein can undergo conformational and orientational changes. Upon adsorption, a protein can retain the conformation or structure it has in the biological environment or it may conformationally change in response to local environments. The nature of the biomaterial surface strongly influences the composition and recognizability of the adsorbed protein layer, which in turn affects the subsequent cellular interactions. Thus, to understand the biological response to a biomaterial, especially in vitro, one must fully understand the nature of the adsorbed protein film that forms on that biomaterial. X-ray photoelectron spectroscopy (XPS), static time-of-flight secondary ion mass spectrometry (ToF SIMS), scanning probe microscopy (SPM), and near edge x-ray absorption fine structure (NEXAFS) are some of the surface science techniques that can be used to characterize adsorbed protein films. XPS provides information about the amount, thickness, and coverage of adsorbed protein films. Static ToF SIMS combined with multivariate analysis provides information about the type, amount and conformation of adsorbed proteins. SPM and NEXAFS provide information about the shape and orientation, respectively, of adsorbed proteins. Using these techniques in a complementary manner can provide the detailed information needed to correlate the surface structure and composition of a biomaterial to the type of protein and cellular interactions that occur with that surface. Several examples showing how biomaterial surface structure is related to the adsorption of proteins and subsequent cellular reactions will be discussed. These examples will range from biomaterials that resist protein adsorption [e.g., poly(ethylene glycol)] to those that tightly bind proteins [e.g., fluorocarbons].
*NESAC/BIO is supported by NIH grant RR-01296 from the National Center for Research Resources.

INV.9

A discussion of the Behavior of Titanium Under High Energy Ion Implantation

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Ion implantation has been used routinely for more than 30 years. In this period a great amount of information has been collected on the physical processes involved in ion implantation in solids, spanning topics such as stopping power, radiation damage, sputtering, ion mixing, defects, diffusion, and many others. Many models, like the spike model, have been developed to explain these processes, and detailed calculations have been made, for instance, using molecular dynamics and Monte Carlo techniques. In spite of the copious knowledge that has accumulated, new effects are still being observed, partly due to increasing the energy regime, but also to the availability of new more sensitive experimental techniques. Recent results [1,2] of the formation of a new phase in titanium and the alloy Ti-6Al-4V when they are bombarded with different MeV energy ions will be discussed, and their relation to various models. The appearance of the new phase does not depend on type of implanted ion (C, Si, Ti, Pt and Au), so chemical effects are ruled out. The amount of the new phase produced does not follow the regular behavior of the nuclear stopping power, which in this energy regime is orders of magnitude more intense for heavy ions than for light ions. Therefore the application of the displacement and thermal spike model must be investigated further.
The support of CONACYT projects F036-E9109 and G0010-E is acknowledged.

[1] R. Trejo-Luna, L.R. de la Vega, J. Rickards, C. Falcony and M. Jergel, J. Mater. Sci. 36(2001)503.
[2] L.R. de la Vega, R. Trejo-Luna, J. Rickards, C. Falcony and L. Baños, *to be published*.

INV.10

X-ray Reflectivity Study of a W/Si Multilayer Grating

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Multilayer gratings are thin film structures with unique optical and electronic properties utilized in X-UV optics (mirrors) and microelectronics (quantum wires), respectively. The structural characterization is of primary importance to control the dominant properties of interest. The x-rays provide the only non-destructive tool giving access to the surface morphology and internal structure of the grating at the same time. We have studied an optical lamellar W/Si multilayer grating with nominal lateral and normal periods of 800 nm and 8 nm, respectively, prepared by electron beam evaporation and electron beam lithography. Coplanar and non-coplanar X-ray reflectivities have been measured with laboratory and synchrotron sources, respectively. The vertical layer set-up and the interface roughnesses are determined from the fit of coplanar measurements with the calculation performed within the dynamical theory of X-ray scattering. Non-coplanar measurements are discussed qualitatively using constructions in the reciprocal space. Slight imperfections of the real grating structure due to the preparation procedure have been revealed and are discussed.
a: on leave from Institute of Physics, Slovak Academy of Sciences, Bratislava, Slovakia
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INV.11

Underpotential Deposition of Cu on Bromide-Modified Au(111): an *In Situ* Scanning Tunneling Microscopy Study

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Continuing with our recent study of Cu undepotential deposition (UPD) on iodine-modified Au(111), we present results from Cu UPD on bromide-modified Au(111) electrode surfaces in sulfuric acid solutions. As in the case of iodine, the bromide adlayer undergoes structural changes as copper deposition proceeds until the completion of a Cu monolayer is reached. Scanning tunneling images and cyclic voltammetry results are presented during copper deposition and stripping on and from the Au surface.

INV.12

Optical Properties of Near-Surface Exciton Quantum Wells*

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An overview of investigations on near-surface semiconductor quantum wells, whose optical properties are considerably affected by the interaction of the exciton with the sample surface will be given. Near-surface quantum wells with both weak and strong quantum confinement of excitons will be considered. In the regime of weak confinement, the effective width d of the quantum well is much larger than the exciton radius a0 and, therefore, the center-of-mass motion of the exciton is quantized. In the opposite case (strong confinement regime) the quantum-well thickness d is smaller than a0, hence the electron and hole are quantized separately in the growth direction and form a quasi-2D exciton due to the in-plane Coulomb interaction. When the exciton quantum well is very close to the sample surface, exciton dynamics is determined not only by characteristics of the quantum well, but also by factors such as the no-escape condition for the electron and hole at the sample boundary, the image potential, and surface roughness. Optical spectra (reflectivity, absorption, and light-scattering cross section) for various systems of near-surface quantum wells will be presented. In addition, recent results for magneto-excitons in near-surface quantum wells will be discussed too.
*: This work is partially supported by CONACYT.

INV.13

Porous Silicon Interfaces: Properties and Applications to Optoelectronic Devices

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In this talk we would like to give an insight of some of the potential advantages that porous silicon (PS) surfaces and interfaces present in optical and optoelectronic devices. The results on the properties of the PS interfaces and devices will be mainly based in those obtained in our laboratory, in the OPTIC program of the European Community, in which we have participated as partners and, in a smaller proportion, in results obtained in other laboratories. The potential advantages of the use of PS in optoelectronic devices are mainly due to: a) the surface roughness of the material that makes it to behave as an antireflection coating; b) the PS photoluminescent properties which permit to convert part of the ultraviolet solar spectrum in visible photons with higher quantum efficiency; c) the PS band gap can be adjusted by varying the formation parameters; d) the incident radiation is dispersed by the porous structure and therefore diffused light reaches the junction; e) easiness of fabrication of superlattices and PS graded coatings with optimal optical properties; f) the relaxation of the momentum-conserving rule which makes it PS to behave somewhat as a direct band-gap semiconductor.
A very important previous step while dealing with PS consists in being able to produce samples with reproducible properties. For this object the surface of the films have been characterized by surface and thin film analytical techniques such as XPS, FTIR, TEM, SEM, AFM and micro-Raman spectroscopies. Obviously, it is also important the stabilization of the surface of PS carried out by techniques like rapid thermal processing in oxygen and nitrogen atmospheres and also by hydrogen passivation.
One of the problems that first arises while trying to develop an optoelectronic device based on PS is due to the contact resistance between the metal and the porous silicon. Results are presented for PS contacts to gold, aluminum and titanium, and also to conducting polymers. High values of the ideality coefficient (n) for these devices arise when the high concentration of interface states in equilibrium with the semiconductor is large, as a result of the broken bonds at the surface of the nanostructured layer.
We have determined the optoelectronic properties (responsivity, quantum efficiency, etc.) of porous silicon photodiodes based in PS/metal interfaces of the Schottky type and relate their electrical response to the fabrication parameters. We also described the behavior of solar cells based on PS under standard illumination conditions and found that the angular dependence of their electrical response agrees with a cosine type law. Special interest has been placed in the development of antireflection coatings with very low values of reflectivity in the whole solar spectrum. In addition we describe solar cell structures based on multicrystalline silicon with efficiencies higher than 13 % when PS is prepared electrochemically and around 12 % for stain-eched porous silicon.
Finally, we have developed porous silicon superlattices by periodically varying the electrochemical formation parameters. In this way we control the porosity of the individual coatings which is directly related to the refractive index. TEM cross sectional images have been obtained to determine the thickness and porosity of the layers. Also, by means of micro-Raman spectroscopy we have obtained the crystallite size, stresses and photoluminescent properties as a function of depth. We also prove that interference filters with excellent optical properties can be developed from these superlattices.

INV.14

Properties of Zinc Oxide Thin Films Doped with Several Elements (Al,Cr,Ag) Deposited by Spray Pyrolysis

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The influence of metals doping on the physical properties of ZnO thin films deposited by the chemical spray pyrolysis method, is presented. In particular we study the doping with Al, Cr and Ag incorporated in the starting solution. The influences in optical and electrical properties is a subject of intense studies in several laboratories due to the expected enhancement of the intrinsic physical properties of the ZnO. In this work we present a comparative study of structural, morphological and topological properties of doped ZnO thin films from data obtained using conventional and high resolution electron microscopy together with scanning electron microscopy. The details observed were correlated when possible with parameters and deposition conditions used for each case. For ZnO:Cr thin films, also the influence of doping concentration in the starting solution in the chemical stability of deposited thin films was studied. Additionally the optical and electrical properties of the diverse ZnO: M (M= Al. Cr, Ag) thin films deposited are compared and discussed.

INV.15

Kinetics of Surface-State Laser Annealing in Si by Frequency-Swept Infrared Photothermal Radiometry*

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Frequency-swept ("chirped") infrared photothermal radiometry was combined with conventional single-frequency-modulation of an Ar-ion laser beam to yield a quantitative study of the surface-state annealing processes induced by the low-fluence laser beam on n- and p-type Si wafers. The appearance of a signal transient was found to be strongly dependent on the electronic quality of the wafer surface and was absent in the thermally oxidized p-Si wafer. The low-injection minority-carrier lifetimes and diffusion coefficients were not affected by the laser-surface interaction, but the surface recombination velocity strongly decreased with time of exposure in samples with positive transient. A two-trap rate model was advanced to explain the transient behavior in terms of surface-state annealing and carrier ejection. In the case of samples that exhibit a negative transient we found changes in recombination lifetime as well as front surface recombination velocities but there is not changes in the carrier diffusion coefficients.
*: Trabajo apoyado por Conacyt 32456-E-2000.

INV.16

Highly Efficient Individually Addressable Diode Bars for Printing Applications

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Over 55% power efficiency in 830 nm wavelength range has been demonstrated for four-element individually addressable laser diode mini-arrays. Diodes' performance indicates excellent uniformity and quality of MBE-grown laser diodes. Slope efficiencies of 1.3 W/A and over 1.6 W CW optical outputs at 1.5 A driving current have been achieved from each of the four 55 mm wide aperture diodes constituting the mini-arrays.

INV.17

Fermi Surface Topology and Angle-Resolved Photoemission Results of Bi2212 Syngle Crystals

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Angle-resolved photoemission (ARPES) has been a useful tool to study single particle properties of high-Tc superconducting materials [1].
There are two main approaches of ARPES that are used to study the Fermi surface features of the high-Tc superconductors. The traditional method is based on the measurement of energy distribution curves (EDC) in all high-symmetry directions of the Brillouin zone (BZ) in order to determine the reciprocal space localization of the Fermi level crossing of the quasi-particle bands. The second approach is based on measuring the photointensity within a narrow energy window at the Fermi level (Ef) defined by the spectrometer and photon source resolution to get the distribution of spectral weight near the Fermi level in the k space. This second approach has the advantage that it provides a global view of the topology of the Fermi surface throughout the whole BZ. However, the photointensity images are influenced by strong matrix elements which depend on the angle between the polarization vector of the photon beam and the wave vectors of the initial and final state involved in the photoemission process [2].
We report on recent photoemission data of the normal state of Bi2212 compounds (Tc = 91 K) recorded using high-resolution synchrotron radiation ARPES at LURE. As a function of the incident photon energy, we have performed complete scans of the BZ in two different polarization geometry detections. Particular attention has been paid to the current controversy on whether or not the Fermi surface is electron- or hole-like in the vicinity of the M(,0) high symmetry point. By mapping the spectral weight in the momentum space, we have found substantial additional information concerning the symmetry of those initial states that define the Fermi surface contours. The completeness of our results provides a clear identification of the key features associated to the Fermi surface of the Bi-based high Tc superconductors.
References
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INV.18

Processing Techniques for 3-D Integration Techniques

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Processing techniques that address the interconnect issues required for fabrication of deep sub-micron electronic devices and for three-dimensional (3-D) integration of these components will be described. As the interconnect density increases, alternate methods of providing input/output (I/O) leads on a chip are required. One attractive approach to providing increased connectivity is to use through-wafer interconnects. This reduces the interconnect density on the front surface while providing additional I/O's on the back surface. This also provides a convenient mechanism to integrate two or more silicon die or heterogeneous integration of silicon with GaAs or HgCdTe to form a 3-D integrated structure. Processing techniques under development include: high aspect ratio silicon etching, insulator lining, adhesion/barrier layer deposition, seed layer deposition, electroplating, and chemical mechanical planarization (CMP).
The primary obstacles to implementing 3-D stacking are the inability to form high aspect ratio interconnects with a sufficiently small diameter and, consequently, with sufficiently high density, and the lack of techniques compatible with CMOS technology that can be executed within the thermal budget of completed ICs. The approaches to overcoming these obstacles will be described.
Acknowledgment
This project is supported by the DARPA MTO office and administered by SPAWAR SYSCEN/San Diego, CA under G rant N66001-00-1-8950.

INV.19

A High Resolution Photolithographic Technique

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We report on a high resolution photolithographic technique with an opticalsetup allowing to replicate subnanometric features.
In this technique, a hologram is recorded when the mask is close to the photosensitive material deposited onto a metallic film; both the main and the reference beam sweep the mask in 2D scanning, the main beam traversing the mask while the reference beam comes from a right angle prism yielding evanescent waves, such as in the attenuated total reflection system. A dot array and an electronic microcircuit are registered with this technique.

INV.20

Preparation and Characterization of Hard Coatings

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Hard coatings are a broad class of materials that are used in a wide range of applications from cutting tools and decorative coatings to computer hard disks and windshield screens. They include metals, alloys, oxides, carbides, nitrides, borides, and even diamond - and a wide range of predominantly carbon-based materials with properties similar to diamond. Hard coatings are used commercially as single layers, graded layers, multilayers, and superlattices. They range from µm-scale crystallite size to nm-scale crystallite size, and even amorphous. The coatings are both stable phase and metastable phase materials, as well as multiphase materials. They are made by techniques ranging from purely chemical (CVD) to purely physical (PVD) processes. After presenting this summary of hard coatings in science and technology, I will focus on two ultra-hard materials – carbon and boron nitride. Carbon materials include diamond, diamond-like carbon, and tetrahedral amorphous carbon, and are made by CVD, PVD/CVD, and CVD, respectively. BN has only been prepared by PVD methods. The successes and remaining problems of each will be discussed.

INV.21

Empleo de Arsénico en el Depósito Epitaxial de GaAs por la Técnica MOVPE

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La técnica MOVPE para la realización de estructuras de semiconductores compuestos se remonta a la década de los años 60, la idea de utilizar precursores orgánicos para la obtención de diferentes compuestos permitía flexibilizar las restricciones termodinámicas de los métodos empleados en aquella época.
Esta técnica se popularizó para la obtención de compuestos III-V gracias a la flexibilidad que permitía, debido principalmente a sus virtudes en cuanto a control del proceso, pureza y calidad de materiales, y facilidad de crecimiento de heteroestructuras.
Sin embargo una de las principales desventajas de la técnica es la utilización de reactivos muy peligrosos. En particular la arsina (AsH_3) es un compuesto extremadamente tóxico, cuyo empleo tiende a ser reemplazado por precursores alternativos.
El presente trabajo muestra los resultados del trabajo de investigación de sustitución de arsina por arsénico elemental. El material obtenido es de alta calidad, aunque más compensado que el obtenido por el método tradicional. Entre sus ventajas están la obtención de películas muy delgadas, la obtención de películas tipo p altamente impurificadas con carbono, o el depósito de GaAs sobre substratos de silicio.

INV.22

Simulation of Dispersive Transient Transport in Amorphous Multilayers

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Using the Monte Carlo method we simulate the charge carrier transient transport in amorphous layers of multilayers structures. In particular we studied the effect of the time delay of carriers at interfaces on the shape of transient photocurrents. The characteristics of transient photocurrents in amorphous multilayers, as obtained by the Time of Flight technique, are simulated by random walks through cubic lattices and compared to experimental data from the literature. It was considered different mobility for the different layers in the structure and an energy mismatch at the interface between two consecutive layers. We compared our simulated results with experimental data measured on $Se/Se_{1-x}Te_x$ multilayers. The transient photocurrents measured in these multilayers show a double-peak shape, which remains as a general characteristic for these systems and is explained in terms of the existence of two mechanisms of transport that may occur at the same time. The origin of the double-peak shape adopted by the reported photocurrents is discussed and it is shown that each peak is directly related to the time delay of charge carriers at the layer-layer and contact-layer interfaces respectively. We concluded the existence of two conduction mechanisms involved in the transport of carriers through the multilayers. One mechanism is hopping through localized states of the disordered layers and the other could be thermal activation at interfaces or direct tunneling through barriers.

†: In memoriam.

INV.23

MBE Growth and Characterization of Low Dimensional Systems: Quantum Dots and Two-Dimensional Electron Gas Heterostructures*

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In the present work we show recent results on the molecular beam epitaxy (MBE) growth and characterization of AlGaAs/GaAs two-dimensional electron gas (2-DEG) heterostructures, and self-assembled InAs Quantum Dots (QDs).
2-DEG AlGaAs/GaAs heterostructures have very important applications in devices such as, Quantum Hall effect bars used in metrology to obtain the electrical resistance standard, and high electron-mobility transistors (HEMT) used in the wireless communication industry, where high-speed microelectronic circuits are demanded.
On the other hand QD heterostructures are of interests due to the expectation that the optical transition oscillator strength should be condensed into discrete spectral lines owing to the three-dimensional quantum-size effect. Consequently, given sufficient size uniformity and interface quality, quantum dot materials could provide significant performance benefits when incorporated into optoelectronic devices such as semiconductor lasers.
The AlGaAs/GaAs 2-DEG heterostructures were fabricated in a Riber 32P MBE system. The samples were characterized by photoreflectance (PR) and photoluminescence (PL) spectroscopies, and Hall measurements at 77 K. Internal electric fields were detected by the presence of Franz-Keldysh (FK) oscillations in the PR spectra. From a FK analysis we obtained the GaAs and AlGaAs band-gap energies and the built-in electric fields strength in each sample. Results showed that the sample with highest electron mobility exhibited the lowest internal electric field strength.
In the self-assembled growth of InAs QDs we study the morphological changes after the introduction of Si-impurities at the interface InAs/GaAs. In addition, in situ investigations of the growth have been performed by reflectance difference spectroscopy (RDS) and reflection high-energy electron diffraction (RHEED). By RDS we observe a huge anisotropy induced into the GaAs substrate, presumably related with the intrinsic strain in the Stransky-Krastanov (S-K) growth mode.
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INV.24

Microstructural and Surface Morphological Evolution at the Atomic Scale during the Growth of Polycrystalline TiN: a HR-TEM, XRD, STM, and Modeling Study

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TiN and related transition-metal (TM) nitrides are used as diffusion barriers in microelectronics as well as hard, wear, and corrosion resistant coatings in mechanical and optical applications. Since all TM nitrides are highly anisotropic, control of preferred orientation is essential. We have used a combination of XRD, TEM, and HR-XTEM analyses to show that TiN layers grown by reactive evaporation or sputter deposition at low temperatures (Ts < 450 °C) exhibit competitive texture evolution with a columnar 111 "kinetically-limited" texture eventually becoming dominant. The columns are narrow and facetted with inter- and intracolumn porosity. Higher Ts or the use of high incident N2+/Ti flux ratios (> 5) with low N2+ energies (20 eV) result in non-competitive growth with a fully dense complete 002 orientation from the initial monolayer. The columns are broad-based with flat surfaces. Kinetic Monte Carlo (KMC) modeling, assuming that the activation energy Es for surface diffusion and the Ehrlich barrier Eb at descending step edges are larger on 111 than on 002, provide a qualitative understanding. Quantitative modeling requires transport activation energies (Es, Eedge, Ef, and Eb) and island line tensions vs orientation. To obtain these parameters, we have grown single-crystal TiN(001) and TiN(111) layers at Ts = 700-950 °C under conditions resulting in large (> 1500 Å) atomically-flat terraces. Partial TiN monolayers (qTiN = 0.1-0.4 ML) were then deposited and in-situ high-temperature STM used to following the coarsening and decay kinetics of single and multiple islands (Ostwald ripening) on flat terraces and in single-atom deep vacancy pits. From the results, combined with solutions of the Gibbs-Thompson and diffusion equations, we obtain the atomic transport parameters listed above which are then used as input into higher level KMC and level-set models for predicting microstructural and surface morphological evolution as a function of growth parameters. The simulated and experimentally-determined microstructures and surface morphologies are in good agreement and provide detailed atomic scale understanding of complex surface interactions during reactive film growth.

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1 al 5 de Octubre
Mazatlán, Sinaloa
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SESIÓN DE CARTELES I
POSTERS' SESSION I
Martes 2 de Octubre

PDI: Películas Delgadas I
RECI: Recubrimientos I
POL: Polímeros
SEMI: Semiconductores I
CMI: Caracterización de Materiales I
MS: Magnetismo y Superconductividad
DIEI: Dieléctricos I
BIO: Biomateriales

PDI.1

Preparation and Optical Properties of Au-Dispersed ZrO_2 Thin Films by Sol-Gel Process

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Metallic colloids embedded into glassy matrixes, exhibit a variety of interesting optical properties, and they are very attractive as the material for optical devices. Conventional melting methods used to obtain these composite materials limits the amount of metal incorporated into the glass matrix. The simple sol-gel technique solves the problem, giving excellent results for optical studies of these coatings. In this work we report the optical behavior of our prepared Au-doped ZrO_2 films. TEM studies show Au nanoparticles with sizes in the range from 5 to 20 nm, embedded into the zirconia matrix. The surface plasma resonance value for gold is 556 nm. We found a shift on the SPR position, to higher wavelenghts when samples are thermally annealed. Also, a decreasing in the intensities of these peaks are found for samples treated with monoethanolamine (MEA) vapor. Moreover, an intense absorption peak was found at about 310 nm. We explained these results in terms of changes in the particle size, as well as changes on the dielectric constant of the ZrO_2 network.

This work was supported by CONACYT clave 31222-U

PDI.2

A Novel and Simple Route to the Preparation of CdO Thin Films by the Sol-Gel Technique

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A novel and simple method for the preparation of sol-gel CdO thin films was developed. The method involves the usage of cadmium acetate, glycerol and triethylamine in methanol, at room temperature; this is more simple and economical than other sol-gel routes and leads to the formation of uniform and highly transparent polycrystalline CdO thin films. The influence of the annealing temperature on the characteristics of the films was also explored in the 200–450°C range. It was found that the XRD-derived grain size increases with temperature, while preliminary resistivity measurements show that this parameter changes from 2×10^{-3} to 3×10^{-4} Ω cm, with a minimum at 300 °C, as the annealing temperature is increased. In contrast with most literature reports, these films show a transmission of *ca.* 100 % at wavelengths > 500 nm, and present an absorption edge characteristic of both a direct (~2.6 eV), and an indirect (~2.0 eV) band gap.

PDI.3

Optical properties of PbS thin films chemically deposited at different temperatures

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PbS thin films were deposited on glass slide substrates using the chemical bath deposition technique. The films were obtained at reaction bath temperatures of 10, 15, 20, 25 and 30ºC. The properties of the PbS films were studied by x-ray diffraction, atomic force microscopy and transmission and reflection spectroscopy measurements. The reflection and transmission spectroscopy of the films were fitted to the Tauc-Lorentz model to obtain their thickness, average roughness and complex dielectric functionε $(E) = \varepsilon_1(E) + i\varepsilon_2(E)$. Both the real and imaginary part of the complex dielectric function of the films were examined as a function of temperature deposition. The results were compared with the ε(*E*) spectrum of bulk PbS .

PDI.4

Preferential Orientation in CdS thin films Chemically Deposited

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CINVESTAV-Querétaro

In this work was studied the influence of a pH controller solution or buffer, under optical and structural properties of CdS thin films chemically deposited. The CdS films were growths in several baths whose containing citrate like the complexing agent of Cd^{++}, thiourea like $S^{=}$ source, a source of $OH^{=}$ and buffer on volumes variability from 0 to 20 ml, the deposition temperature was 70 ºC. About the structural properties, a total preferential crystal direction to (002) of CdS hexagonal phase was found. Through this systematic study was connected buffer with the better crystalline quality of CdS films chemically grown, whose in addition shows good optical properties like high visible transmittance and low UV transmittance. Although Reflectivity and Trasmitance studies also was possible to get measurements of films thickness and more important optic information like optics constants, dielectric function and band gap.

PDI.5

Estudio de Películas Delgadas Para Ser Empleadas en Dispositivos Fotovoltaicos

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Los compuestos II-VI de película delgada han sido de interés por su aplicación en numerosos dispositivos, tal es el caso de los materiales semiconductores en película delgada como el Selenuro de Cadmio (CdSe) y el Sulfuro de Cadmio (CdS) que son conocidos por ser una pareja excelente para formar una heterounión en dispositivos fotovoltaicos, siendo utilizado el CdSe como absorbente y el CdS como una ventana de la radiación en los dispositivos fotovoltaicos.
Existen muchas técnicas para crecer estos materiales, de entre las cuales destaca la de Baño Químico por ser muy versátil y económica.
Debido a que las propiedades de las películas delgadas dependen por lo general de las condiciones de crecimiento, se crecieron películas policristalinas de CdS sobre un substrato de vidrio por Deposición de Baño Químico (CBD), las cuales fueron dopadas con Er^{+3} durante el proceso de crecimiento, para mejorar sus propiedades ópticas y eléctricas. Las películas que se obtuvieron, crecieron en fase cúbica, esto se determinó por los difractogramas de rayos-X, en los que se muestra una buena calidad cristalina. Usando la derivada de la absorción se determinó el valor del Gap como función de la concentración de dopante. Mediante la conductividad en el obscuro se observó la conductividad de las muestras dopadas con Er^{+3} mejoró notablemente con respecto a las muestras as-grown. A través de la termopotencia se determinó la concentración de portadores activos y su evolución en las muestras de CdS:Er^{+3}. Se muestran los efectos del tratamiento térmico a la muestra más conductivas de las dopadas en el rango de temperaturas 198- 402 °C.

PDI.6

Electrical Properties of CdS:Er^{3+} Thin Films Grown by CBD

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Cadmium sulfide thin films were prepared by chemical bath deposition on glass substrates at 80 °C. CdS was Er-doped during the growth process by adding water-dilutes $Er(NO_3)_3 \bullet 5H_2O$ to the growing aqueous solution. The relative volume of the doping solution was varied in order to obtain different doping levels. Crystalline structure of CdS:Er layers was cubic zincblende for all doped-layers prepared. The (111) interplanar distance changed in irregular way with the Er doping level. Consequently, the energy band gap (E_g) firstly increases and afterward diminishes becoming, at last, approximately constant at arround E_g=2.37 eV. For higher doping levels, in as-grown films, dark electrical conductivity (σ) values reach about 1.8 x 10^{-2} Ω^{-1} cm^{-1} at room temperature. Logarithm of σ versus 1/kT curves, where k is the Boltzmann's constant and T the absolute temperature, indicate an effective doping of CdS as a result of the Er introduction into the lattice of the material.

PDI.7

Microstructural and Optical Study On Annealed CdS:Er^{3+} Thin Films

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Policrystalline CdS:Er3+ thin films were prepared by chemical bath deposition method and then anneled into an Ar+S2 enviroment.By using X-rays diffraction and Optical Absorption these samples were studied. The firts characterization technique allow us to observe that the as-grown sample are in the cubic phase and it does not change when the thermal annealing increaces, but the interplanar distance increces as a influence of the thermal annealing. On the other hand, by Optical Absorption a narrowness on the Eg value was observed.

PDI.8

Characterization of CdS:Tb^{3+} Prepared by Chemical Bath Deposition

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By using the Chemical Bath Depositon Technique has been deposited polycrystaline thin films of CdS doped with Tb^{3+} and prepared with the following concentrations: $CdCl_2$ 0.02M, KOH 0.5M, NH_4NO_3 1.5M, $SC(NH_2)_2$ 0.2M and $Tb(NO_3)_3 \bullet 5H_2O$ 1.0M.Ten samples were prepared with relative volumen of Tb^{3+} ions and its growth temperature was of 80°C, the reaction time was 40 minutes. X Rays Diffraction, UV-VIS optical absorption and dark conductivity were used for the charaterization of the samples. Differents changes of band gap energy (E_g), lattice´s parameter and conductivity were obtained, but a important fact is that the conductivity values were three order of magnitud bigger than the not doped sample.

PDI.9

Influence of the Al Content in the Optical Properties of ZnO Thin Films Obtained by the Sol-Gel Technique

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ZnO thin films were prepared by the Sol-Gel technique, with the addition of 0.001 - 1 at. % of aluminum with ½order of magnitude intervals, as well as some selected values in the 2 - 20 at. % range. The metal salts employed were zinc acetate dihydrate and aluminum(III) nitrate nonahydrate. The films were annealed at 400 °C in air, showing high transparency, uniformity and good adherence to the substrate. We found that the improvement of the transmission of the films, with respect to those of pure ZnO, as well as the shift of the absorption edge towards higher energies, are consequences of the formation of the corundum phase of Al_2O_3 in the films.

PDI.10

Electrical Behavior of $(ZnO)_{1-y}(Al_2O_3)_y$ Thin Films Obtained by the Sol-Gel Technique

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We carried out a study of the electrical properties of sol-gel prepared $(ZnO)_{1-y}(Al_2O_3)_y$ thin films in the $0.001 \leq x \leq 20$ at. % range of aluminum concentration in solution (whereas "y" is related to the *film* composition). The films were thermally treated at 400ºC and are electrically stable. The conductivity of the films was evaluated from sheet resistance measurements, the highest value being obtained for the film with x = 2 at. %. The number and energy levels of traps were estimated by means of a photoconductive decay analysis; it was found that the number of traps decreases from 5 to 3, with the increase of the Al percentage in solution (x). The results obtained allow us to propose that the transport mechanism in the $(ZnO)_{1-y}(Al_2O_3)_y$ films is dominated by the grain boundaries, where the presence of Al_2O_3 notably modifies the electrical properties of the material for concentrations larger than 0.5 at. %.

PDI.11

Rigorous Diffraction of an Electromagnetic Beam by Wavelength-Size Slits

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In this paper the rigorous diffraction of an electromagnetic gaussian beam by N slits in a perfectly thin conducting screen (line finite grating of period D) is studied. The T.E. polarization case is considered , i.e. when the electric field is parallel to the slits. The evolution of the diffraction pattern in far-field as a function of the number of slits and the wavelength is analyzed. We show that the Huygens-Fresnel´s classical theory cannot predict some features on the spectrum when the wavelength lies in the vectorial region ($\lambda/l > 0.2$). Finally, the transmission coefficient and the spectrum are studied as a function of several optogeometrical parameters.
Work supported by the project No. I35695-E from CONACyT México.

PDI.12

Deviation From Thermodynamic Equilibrium at Low Temperature Metalorganic Chemical Vapor Deposition (LT-MOCVD) of Gallium Nitride (GaN)

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LT-MOCVD growth runs of GaN are conventionally used for the formation of the nucleation layers prior to epitaxial growth of GaN is substantially determined by the low temperature (LT) grown layers. Therefore, study of the LT runs is very important. One of the main characteristics of the crystal growth is its "driving force" that is the affinity of the heterogeneous formation reaction of the GaN. The ratio between the affinity of the reaction and temperature in the energy units is the quantitative criterion of deviation from thermodynamic equilibrium whereby the ratio between the rates of the right and the back reactions can be estimated. LT-MOCVD of the GaN epilayers on both basal planes is presented. One and two variants of the GaN formation reactions on (0001) A and (0001) B planes, respectively, are described. Trimethylgallium and ammonia are considered as the precursors of the gallium and nitrogen, respectively. Decomposition of ammonia is presented as the catalitic reaction on the surface of the growing layer. The ratios between the affinity and temperature in the energy units are substantially larger than unity for crystallization processes on both planes. Thus, the considered formation reactions are far from thermodynamic equilibrium and, respectively, the rates of the back reactions are negligible small with comparison to the rates of the right reactions. Far from thermodynamic equilibrium growth conditions lead to formation of thermodynamically stable hexagonal and thermodynamically metastable cubic crystal modifications of GaN in the same growth process.

PDI.13

Respuesta Óptica de Modos Longitudinales Polaritón-Excitón en Películas Delgadas

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El efecto de cuantización polaritónica y la localización del excitón cerca de las superficies en una película de $CuCl_2$ son estudiadas teóricamentea través de la respuesta óptica. Los parámetros de amortiguamiento de volumen y superficial son obtenidos a través de un ajuste a un espectro de transmisión a incidencia normal (Phys. Rev. **B** 52, 2640 (1995)). Para el cálculo de la reflexión a incidencia oblicua: polarización *-s y -p* (R_p *y* R_s), se utiliza un potencial superficial realista. Mostramos como los modos longitudinales de superficie se manifiestan en R_p en forma mínimos profundos. Se presentan también espectros de Δ_{45}, es decir, la diferencia entre R_p *y* R_s^2 medido a un ángulo de incidencia de 45°, los cuales resultan sensibles a las resonancias longitudinales, sin embargo, estas resonancias no son distinguibles en la reflectividad R_p de la película sobre un sustrato.

PDI.14

Sum-Frequency Generation in the Scattering of Light by Randomly Rough Metallic Surfaces

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We present results of numerical calculations of the sum frequency generation in the scattering of light on randomly rough metallic surfaces. For surfaces with relatively large roughness and slopes, we find that the angular distribution of the scattered light at the sum of frequencies display well defined minima in the direction given by k||(ω3)=k||(ω2)+k||(ω1), where k||(ωi) is the tangential component of wave number at the corresponding frequency.

PDI.15

Growth and Characterization of InGaP/GaAs Heterostructures

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The growth technology of InGaP solid solution on GaAs substrate by LPE was developed. During this work some peculiarities of the growth process of this material were investigated. It was shown that it is necessary to diminish the erosion of the GaAs substrate in the contact with the In-Ga-P liquid phase. The erosion is the result of a non-equilibrium between liquid and solid phases. Some methods to diminish this erosion were suggested. Also, it was shown that it is necessary to control the composition of the In-Ga-P liquid phase with very high accuracy for the growth of high quality InGaP epitaxial films. The same liquid phase can be used several times to grow the epitaxial layers. The composition gradients along the thickness of the epitaxial layers were investigated. The photoluminescence (PL) spectra of the grown samples were also investigated. Finally, a strong influence of the substrate on the PL characteristics of the InGaP layers was found. This dependence is explained and discussed in this work.
*Becario de CONACYT

PDI.16

No Reciprocidad y Magnetorreflectancia de una Película Metálica con Superficie Libre Rugosa en la Configuración de Faraday

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Utilizando la teoría modal de Rayleigh-Fano y modelando la superficie con una función armónica, se hace un estudio clásico de la respuesta óptica de una película metálica con superficie libre rugosa, cuando ésta se encuentra afectada por un campo magnético paralelo al vector de propagación y a la superficie del metal (geometría de Faraday). Se presentan las relaciones de dispersión para parámetros de rugosidad diferentes y se muestra la propiedad de no reciprocidad en la magnetorreflectancia. Las relaciones de dispersión muestran un gap que es función de la magnitud del campo magnetostático aplicado.

Trabajo apoyado parcialmente por CONACyT

SEMI.1

Photoluminescence Study of Two Dimensional AlGaAs/GaAs Heterostructures Grown by MBE

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High electron mobility AlGaAs/GaAs heterostructures containing a two dimensional electron gas were analyzed by Photoluminescence Spectroscopy (PL) at 10 K. The heterostructures were grown in different MBE systems. Samples with higher mobility figures exhibited a sharper excitonic peak with a full-width at half maximum in the order of 0.5 meV and a weaker carbon signal. The PL excitonic signal become wider when the mobility and excitonic to carbon peaks ratio decreased. We will discuss the samples characteristics as related to interfacial internal built-in electric fields, calculated from Photoreflectance spectra, due to impurities unintentionally incorporated during the preparation of the heterostructures.

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SEMI.2

Photoluminescence and Surface Morphology Studies of GaInAsSb Highly Doped With Tellurium Grown by Liquid Phase Epitaxy on (100) GaSb

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Tellurium-doped GaInAsSb epitaxial layers with electron concentration in the range from $3x10^{17}$- $2x10^{20}$ cm^{-3} are grown at 530°C on (100) GaSb substrates by liquid phase epitaxy (LPE). To dope the layers we used pellets of Sb_3Te_2 in preparing growth melts. We have made a systematic study of the surface morphology by scanning electronic microscopy and optical properties by low temperature Photoluminescence in function of the tellurium doping. The low temperature photoluminescence (PL) spectra (20 K) presented a dominant peak, this peak is constituted for three transitions associated to bound excitons to the residual acceptor impurities. BE_2, the excitonical transition bound exciton to neutral acceptor, disappearing for high doped layers with tellurium.

SEMI.3

Optical Properties by Photoluminescence and Infrared of Thin Films of GaAs Obtained by MOCVD

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We have studied the optical properties of thin films GaAs (100) grown MOCVD. We used photoluminescence and infrared spectroscopy for characterizing the thin films. The low temperature photoluminescence spectra presents a dominant transition associated to residual impurities, and also the excitonical transition. This was verified using infrared spectroscopy, which permitted to identify the residual shallow impurities. We obtained as Carbon-substitutional, Ga_2O_3, molecular oxygen, humidity and, two unidentified peaks.

SEMI.4

Raman and Hall Characterization of GaAlAs Epilayers Grown by MOCVD

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MOCVD GaAlAs thin films were characterized using Raman and Hall measurements. The GaAlAs thin films were grown by MOCVD using solid arsenic instead of arsine as the arsenic precursor. Some difficulties in MOCVD growth of GaAlAs are the composition homogeneity of the layers and the oxygen and carbon incorporation during the growth process. The composition homogeneity of the films was demonstrated by the Raman measurements. Hall measurements on the samples shown highly compensated material. Samples grown at temperatures lower than 750 °C were highly resistive, Independently of the V/III ratio, the samples grown at higher temperatures were n-type. As the growth temperature is increased the layers compensation decreases but the Raman spectra show the layers become more defective.

SEMI.5

Temperature Dependence of the Photoluminescence of AlGaAs/GaAs Quantum Wells on Cl_2 Etched Substrates

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We have studied the optical properties of in-situ Cl_2-etched GaAs surfaces and overgrown $Al_xGa_{1-x}As$/GaAs quantum wells (QW) structures. The GaAs surfaces were in-situ Cl_2-etched at temperatures of 70 and 200°C [1]. For comparison proposes similar QWs were grown on ex-situ etched GaAs surfaces. The behavior of the excitonic transitions from the GaAs substrate and that from the quantum wells was studied by photoluminescence spectroscopy (PL) as a function of the temperature in the range 10-300 K. The temperature dependence of the excitonic peaks was analyzed employing the Varnshni, Bose-Einstein and Passler-Oelgart models [1]. We will discuss the parameters variations in each model depending on the etching conditions.

[1] M. López, J. Luyo, M. Meléndez, O.Cano, C. Megía, J. Ortiz, and G. Contreras, J. Vac. Sci. Technol B 18, 1553 (2000).
[2] R. Passler and G. Oelgart, J. Appl. Phys. **82**, 2611 (1997).

SEMI.6

Optical and Structural Characteristics of AlGaAs/GaAs Multiquantum Wells

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We have grown $Al_xGa_{1-x}As$/GaAs multiquantum wells (MQWs) structures by molecular beam epitaxy. The number *N* of quantum wells in the structures was varied from 1 to 20. For the samples structural characterization we employed scanning electron microscopy and atomic force microscopy. The MQWs excitonic transitions were studied by photoluminescence spectroscopy at 14 K. In addition, photoreflectance spectroscopy (PR) measurements were carried out at room temperature. Internal electric fields were detected by the presence of Franz-Keldysh (FK) oscillations in the PR spectra. From a FK analysis we obtained the GaAs band-gap energy and the internal built-in electric field strength in each sample. We will discuss the changes in the optical and structural properties of the samples as a function of *N*.

[1] D. E. Aspnes and A. A. Studna, *Phys. Rev. B* **7** (1973) 4605.

SEMI.7

Application of a Lock-In Common-Mode-Rejection Demodulation to Monitor Ion Implantation in Si Wafers Using Infrared Spectroscopy.

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In this study a comparison between the conventional frequency-scan and new common-mode-rejection-demodulation (CMRD) photothermal radiometry (PTR) methods were used to characterize ion-implanted Si wafers. B, P and As ion-implanted Si wafers in the implantation dose range $1x10^{11}$-$1x10^{13}$ions/cm^2 were studied. We found that CMRD can significantly enhance the resolution of PTR response curves from P and B ion-implanted wafers in cases where conventional square-wave frequency scans were totally or partially unable to resolve the dose. The dose resolution improvements afforded by the CMRD technique may be important toward better control of the ion-implantation process in electronic devices, in a dose range which has traditionally been difficult to monitor optically owing to the effects introduced by the early stages of the amorphization process in the implanted layer.

SEMI.8

Raman Studies of Mixed Amorphous and Microcrystalline Phases of Silicon Films Produced by PECVD

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We have realized a study of Raman scattering of Aluminum films on phosphorous-doped hydrogenated amorphous silicon (n^+ a-Si:H). These thin films of amorphous silicon heavily doped (n^+ a-Si:H) were deposited by Plasma Enhanced Chemical Vapor Deposition (PECVD). After of the deposition the films were annealing in a furnace at 250 °C in nitrogen ambient during several hours. The samples were deposited on silicon wafers and on glasses. According to Raman results we observed mixed amorphous and crystalline phases in the films deposited on silicon wafers and separated amorphous and crystalline phases in films deposited on glass. It was analyzed the intensity and the half width of the observed crystalline and amorphous Raman modes as a function of annealing time and conductivity. We estimated the spatial correlation length of the microcrystals formed in the amorphous matrix for different annealing times.

SEMI.9

Raman Studies of Carbon Doped GaAs Epilayers Grown by MOCVD

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High quality carbon doped GaAs epilayers were grown by MOCVD using trimetylgallium (TMG) and metallic arsenic as gallium and arsenic sources respectively. For controlling the carbon doping, a mixure of hydrogen and nitrogen was used as carrier gas. Raman scattering spectra show the TO and LO modes at 270 and 290 cm^{-1} respectively. The relative intensity of the LO mode between the undoped and doped samples served to estimate the hole concentration of carbon in the epilayers, and these results are corroborated by Hall measurements. The range of concentration analyzed goes from 10^{17} to 10^{19} cm^{-3}. The TO mode are mixed with the LO phonon-plasmon coupled (LOPC) mode due to the carrier concentration, and the decreasing of the intensity of the LO mode is due to the decreasing of the depletion layer as the concentration increases. These effects in the GaAs epilayers are reported.

SEMI.10

Estudio de la Fotomodulación en Películas de Cds Crecidas por la Técnica de Erosión Catódica (*Sputtering*) Magneto Planar

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En este trabajo se presentan los resultados obtenidos al hacer mediciones de fotomodulación en películas de Sulfuro de Cadmio (CdS) crecidas por la técnica de Erosión Catódica Magneto-Planar (Sputtering) bajo diferentes parámetros de crecimiento, como son el tiempo de deposición (td) y la temperatura del substrato (ts), teniendo como objetivo realizar el estudio de las transiciones electrónicas que se presentan en dichas películas en el rango de 2.0 eV a 3.0 eV en función de estos parámetros a temperatura ambiente.
*Trabajo parcialmente apoyado por CONACyT y el DAAD (Deustche Akademische Austauschdienst).

SEMI.11

First Principles Study of Phase Transitions in GaAs and AlAs Under Hydrostatics Pressure

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Studies of structural phase transitions under high pressures of AlAs and GaAs are presented using first principles calculations with Vanderbilt pseudopotentials and LDA approximation (Local Density Approximation) in the framework of the Density Functional Theory (DFT). The zinc-blende, sc16 and wurtzite phases were studied for both compounds. Comparations between experimental and theoretical data of critical pressures, equations of state and structural parameters are accomplished. Additionally, our results are compared with other results in the literature, in order to check the usefulness of the "ultrasoft" pseudopotentials in this type of studies. This work has been supported by the project CONACyT No. **32213-E**

SEMI.12

Optical and Structural Caracterization of GaN Films Grown on Si Substrates

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Here we present a study of the effects of the orientation of SiC-coated Si substrates on the MBE growth of GaN. The GaN layers were grown in a conventional MBE system with an RF activated nitrogen plasma source. (100)- and (111) oriented Si substrates were chemical treated in a HF solution, and then annealed in the MBE preparation chamber under a C_2H_2 partial pressure. This resulted in the formation of ~ 2.5 nm-thick SiC epitaxial layer. The GaN layers were studied by Raman scattering, transmission electron microscopy and x-ray diffraction. Based on the characterization by these techniques; we found that the growth on SiC-coated Si(100) leads to cubic GaN films, whereas the growth on SiC-coated Si(111) resulted in predominantly hexagonal GaN. However we noted that a mixture of both phases appeared in the films when using non optimized growth conditions.

SEMI.13

Study of Residual Strains in *in-situ* Buried Multi-Quantum Well Mesa-Stripe Arrays

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We have performed an analysis of the residual strains in quantum wires fabricated by *in-situ* Cl_2-etching on molecular beam epitaxial (MBE) grown AlGaAs/GaAs multi quantum wells (MQWs)[1]. Patterned samples with mesa-stripes along the [010], [-110] and [110] crystal directions on GaAs (001) substrate were studied. Atomic Force Microscopy (AFM) and Transmission Electron Microscopy (TEM) was used to obtain information of the structural and morphological properties. The shifts in the photoluminescence (PL) excitonic peaks at 10K were used to estimate the residual strains as a function of the wires width. From AFM and TEM results we observed clearly that [110] oriented wires presented a higher density of crystal defects, which are correlated with PL analysis.

[1] M. López-López, et al. 19th North America Conference on MBE, Book of Abstract, 2000

SEMI.14

A Study on the Electrical Properties of the Novel Semiconductor Alloy $Cu_xCd_{1-x}Te$ as a Function of Copper Concentration

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It has been shown previously that the incorporation of Cu into Cd sites at concentrations around 0.3 at.% produces films with high crystalline quality when compared to pure CdTe or to $Cu_xCd_{1-x}Te$ with higher copper concentrations. The improvement on the structural properties may produce an important effect on the charge transport properties of this novel semiconducting alloy. For instance, we have observed that the resistivity at room temperature drops several orders of magnitude when the amount of copper in the films is varied. In this study we show the results of electrical measurements on $Cu_xCd_{1-x}Te$ films for $0.001 \leq x \leq 0.12$ at.% as nominal concentrations.

SEMI.15

Effects of the Presence of Oxygen During the Growth of $Cu_xCd_{1-x}Te$ Thin Films by R.F. Sputtering

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High quality films of the novel semiconductor alloy $Cu_xCd_{1-x}Te$ have been successfully grown by rf sputtering from a single target made of a mixture of Cu and CdTe powders. Micro Raman experiments carried out on the Cu powder showed the existence of a CuO overlayer. However, the presence of such oxide, or of oxygen molecules, have not been detected as important components in the films. The role that oxygen plays during the growth and properties of the $Cu_xCd_{1-x}Te$ films is not clear to date. In this work we report the results of a study about the effects of incorporating controlled amounts of oxygen, during growth, on the composition and on the crystalline and optical properties of the films. This study is being carried out in a two-target sputtering system, in which one target is made of CdTe and the other of Cu. The native oxide on the Cu target is removed by previously pre-sputtering the Cu target for a few minutes before opening the deposition shutters.

SEMI.16

Sulphur Over-Pressure and Substrate Temperature Effects on the Growth of Stoichiometric MnS Thin Films

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Manganese sulphide (MnS) is a wide band gap semiconductor that crystallizes in its stable form with the octahedrally coordinated rocksalt structure, presenting as well other metastable structures: cubic (zincblend) and hexagonal (wurtzite). One of the problems that have precluded the application of MnS in devices has been the little work carried out so far to grow high quality MnS films. To date, most of the efforts done on MnS films have been using chemical bath and thermal evaporation as preparation techniques. These two methods yielded amorphous and polycrystalline films, respectively. To our knowledge, no report exists so far on the growth of MnS by rf sputtering due to the technical difficulties involved. In this work we report on the appropriate conditions for the growth of nearly stoichiometric MnS films prepared by rf sputtering and the important effects of sulphur over-pressure and substrate temperature on films composition and structure. The produced films were polycrystalline with an energy band gap of around 3.4 eV, a value that makes MnS an appealing material as an optical window for device applications such as solar cells.

SEMI.17

Crystalline Growth of Be_3N_2 Thin Films by Reactive Laser Ablation

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Recently was reported that beryllium nitride alpha phase, α-Be_3N_2, possess a direct bandgap in the range of 4.05-4.47 eV[1], making it an attractive material for optoelectronic applications. At present there are very few reports on the preparation of thin films of this material [2]. In this work, we have deposited α-Be_3N_2 thin films on silicon substrates at different temperatures by laser ablating a beryllium foil in molecular nitrogen ambient. The morphology, structure and composition of the films were determined by atomic force (AFM), scanning electron (SEM), and transmission electron (TEM) microscopies, auger electron (AES), X-rays photoelectron (XPS) spectroscopies. From these results, we demonstrate that the epitaxy beryllium nitride on silicon substrates is readily achievable.

[1] Ma. Guadalupe Moreno Armenta, Armando Reyes-Serrato, and Miguel Avalos Borja, Phys. Rev. B **62**, 4890 (2000).
[2] G. Soto, J. A. Díaz, R. Machorro, A. Reyes-Serrato, and W. de la Cruz. To be published in *Materials Letters*

SEMI.18

Structural and Optical Properties of Sprayed ZnO Thin Films

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Spray pyrolysis technique enhanced by ultrasonic waves was used in order to obtain ZnO thin films. The variables in the process were: concentration of the sprayed solution and substrate temperature. Zinc Acetylacetonate ($C_{10}H_{14}O_4Zn$) was used as the precursor compound diluted in N, N-dimethylformamide (N, N-DMF). The final solution with 0.25, 0.5 and 1gr of zinc acetylacetonate diluted on 100ml of N,N-DMF was sprayed either on glass slides or silicon substrates. The substrate temperatures were 300, 400 and 500°C. X-ray diffraction, scanning electron microscopy, atomic force microscopy, ellipsometry, electron dispersion spectroscopy and optical transmission were used to study the structural and optical properties of these films. This research in this kind of films is addressed for the application as CO sensors.

SEMI.19

Producción de Silicio Poroso Mediante Ataque Químico de Substratos de Silicio con Diferentes Orientaciones Cristalográficas*

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Reportamos resultados de la caracterización de silicio poroso producido mediante ataque químico de sustratos de silicio con orientaciones: (100), (1 1 0), (1 1 1), (1 1 4)y (5 5 12). Para realizar los ataques químicos se utilizaron HF, $NHNO_3$ y agua deionizada en diferentes proporciones. Las técnicas de caracterización empleadas fueron reflectividad óptica UV-Vis, microscopia de fuerza atómica, microscopia de barrido y fotoluminiscencia a temperatura ambiente. Las resultados de fotoluminiscencia fueron correlacionados con la estructura observada mediante las microscopias de barrido y fuerza atómica.

*: Trabajo apoyado parcialmente por CONACyT

SEMI.20

Solución Única al Ajuste Multiparamétrico de la Señal de Radiometria Fototérmica en Semiconductores: Silicio

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Se muestra un modelo teórico para obtener una solución única en el ajuste multiparamétrico del análisis de la señal de radiometría fototérmica infrarroja (PTR) en obleas de silicio. Este modelo estudia de manera teórica y experimental, la influencia de los parámetros termoelectrónicos tales como: tiempo de vida de portadores minoritarios (τ), velocidad de recombinación delantera y trasera (V_{sf}, V_{st}), coeficiente de difusión de portadores (D_{np}) y difusividad térmica (α) en la contribución térmica y electrónica de la señal PTR como función de la frecuencia.
Las propiedades de transporte electrónico en semiconductores son parámetros físicos de gran interés para la realización en la integración de semiconductores a gran escala (LSI). La evaluación de esos parámetros es esencial en caracterización de obleas semiconductoras y para la fabricación modelada de los circuitos sobre Si. Técnicas de detección fototérmicas se han desarrollado para monitorear, tanto propiedades cinéticas, como de transporte de los portadores fotogenerados en semiconductores. Los estudios fototérmicos se basan sobre el hecho de absorción por semiconductores de una radiación visible modulada, que da como resultando variaciones de temperatura que afectan las características térmicas y eléctricas del material.

Este trabajo es parcialmente apoyado por CONACyT (32456E-2000)

SEMI.21

Efecto de la Iluminación en el Ángulo de Contacto del Agua en Películas Delgadas de PbS Determinadas por el Método de Wilhelmy.

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En publicaciones anteriores, describimos las propiedades de semiconductores de silicio cristalino y películas delgadas de silicio amorfo hidrogenado y de diamante, el ángulo de contacto de agua tridestilada se modifica cuando la superficie del material se ilumina. El cambio en el ángulo de contacto depende de la estructura química de la superficie y de la longitud de onda del haz incidente. Aquí presentamos los efectos que se observan en películas delgadas de sulfuro de plomo. Las determinaciones se llevaron a cabo por el método de Wilhelmy. Estos fenómenos están relacionados con el fotovoltaje de superficie que genera la iluminación. También se observa que los ángulos de contacto varían fuertemente dependiendo de si la superficie del material se aterriza o si se mantiene eléctricamente aislada. Los resultados se interpretaron en términos de un equivalente de la curva electrocapilar, esto permitió caracterizar el carácter eléctrico de las superficies p(+) o n(-). Los resultados son reversibles siempre y cuando se midan los ángulos de contacto en condiciones de equilibrio.

SEMI.22

Growth of AlGaAs/GaAs Two-Dimensional Gas Heterostructures by Molecular Beam Epitaxy

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The requirements of high mobility electronic devices have stimulated the interest in the study of two-dimensional electron gas (2DEG) systems, which present great advantages in the operation of metal-oxide-semiconductor field effect transistors (MOSFET´S), high electron-mobility transistors (HEMT´S), and devices based on the Quantum Hall Effect. In this work we report the growth of AlGaAs/GaAs heterostructures by MBE. We studied the growth and structural parameters that can be changed in order to improve the crystalline quality of the heterostructures to obtain a more effective two-dimensional confinement. The crystalline quality of these heterostructures was characterized by room temperature photoreflectance (PR) spectroscopy and Hall measurements at 77 K. A detailed study of Franz-Keldysh oscillations in the PR spectra shows a correlation between the period of the oscillations and the electron mobility of the 2DEG.

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SEMI.23

Substrate Temperature Effects on the Growth of the Semiconducting Alloy $Cd_{0.96}Cu_{0.04}Te$

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Previously, the semiconducting alloy $Cu_xCd_{1-x}Te$ had been successfully prepared by the rf sputtering technique at substrate temperatures lower or equal to 200°C. Such studies were focused on the effects of changing the concentration of Cu in the films. In the this work we present for the first time results on the induced effects of elevating the temperature during growth of $Cu_xCd_{1-x}Te$ films at a fixed copper concentration ($Cd_{0.96}Cu_{0.04}Te$). The temperatures employed were T_s= 200, 250, 300 and 350°C and for comparison films of pure CdTe were grown at the same substrate temperatures. X-ray diffraction patterns show that the $Cd_{0.96}Cu_{0.04}Te$ films tend to growth with wurtzite structure although cubic related peaks were also observed, while for those of pure CdTe the cubic phase is dominant. In addition, the grain size increases in the films as the copper contents and substrate temperature are also augmented. As a consequence, the surface roughness of the $Cd_{0.96}Cu_{0.04}Te$ films was always higher with respect to the CdTe samples grown at the same temperature. For instance, the $Cd_{0.96}Cu_{0.04}Te$ film grown at 350°C had a surface roughness (rms) of 128Å while that of the CdTe films prepared at the same temperature was 56 Å. The energy band gap (E_g) was measured from optical absorbance spectra in the UV-VIS region and obtained that the presence of copper reduces E_g by approximately 0.04 eV with respect to CdTe films, but this difference increases with T_s and at 350°C it was 0.06 eV.

SEMI.24

Influence of the Island Lateral Dimensions in the Exciton Localization Produced by Thickness Fluctuations in $Zn_{1-x}Cd_xSe$ Quantum Wells*

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Atomic layer fluctuations of the thickness of quantum wells (QWs) are one of the causes of exciton localization. Here, we present the results of the determination of the minimum lateral dimensions of islands formed by thickness fluctuations in $Zn_{1-x}Cd_xSe$ QWs which produce full exciton localization. We have calculated the localization energy of excitons in the frame of the factorized-envelope approximation. We found that the excitons are well localized in the islands of the QW when their dimensions are larger than ~15 times the exciton Bohr radius. The dependence of the localization energy as a function of the island size is used to calculate the PL spectra. We will demonstrate that the studied QW structures are indeed of high quality, their lateral dimensions being much larger than the exciton Bohr radius.

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DIEI.1

Strain Measurement of Epitaxial $SrTiO_3$ Films on Si(001)

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Extended x-ray absorption fine structure (EXAFS) of Ti K edge was used to measure the strain in epitaxial $SrTiO_3$ films grown on Si(001). The experiments were performed at beamline X23-A2 of the National Synchrotron Light Source of Brookhaven National Laboratory. The data were acquired for two polarizations corresponding to the sample surface normal (**n**) either parallel or perpendicular to the electric field (**e**) of the x-rays. The fluorescence from Ti was recorded through a single-element SiLi detector. The theoretical EXAFS oscillations were obtained through a software that employs ab-initio calculations. The growth of the $SrTiO_3$ film is such that the [110] and [1-10] axes of $SrTiO_3$ matches the [010] and [100] axes of Si(001). Through this study it was possible to obtain the critical thickness of the system. The differences on the x-ray absorption near the Ti K edge for the two polarizations evidence structural disorder in the surface plane that is related to a distortion of the $SrTiO_3$ perovskite below the critical thickness.

DIEI.2

Caracterización de Materiales Dieléctricos y su Aplicación en Sensores Químicos Tipo ISFET

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Un ISFET (Ion Sensitive Field Effect Transistor) es básicamente un transistor MOS sin electrodo de compuerta (el cual es usualmente de aluminio o polisilicio); por lo que los dieléctricos de compuerta del transistor quedan expuestos al medio ambiente, en este caso, una solución acuosa con un nivel variable de pH o de actividad de iones de hidrógeno presentes en la solución. El ISFET se comporta como un dispositivo sensitivo a iones cuando es sumergido en la solución y para ello, se comparan las respuestas electroquímicas ofrecidas por los dieléctricos estudiados en este trabajo: SiO_2 térmico, Si_3N_4 depositado por LPCVD y una combinación SiO_2-Si_3N_4. Es de esperarse que el dieléctrico con mayor sensibilidad al pH sea Si_3N_4. Siendo el ISFET un sensor químico basado en un dispositivo semiconductor, éste puede obtenerse a partir de tecnologías de fabricación estándares de circuitos integrados, en nuestro caso, con el proceso de fabricación de circuitos integrados CMOS del laboratorio de microelectrónica del INAOE. Por lo anterior, se presenta también el diseño básico del proceso necesario para obtener este dispositivo, poniendo especial énfasis en la protección del mismo cuando se utilice en ambientes corrosivos (soluciones ácidas).

DIEI.3

Charge Transport Through Silica Sol-Gel Films Deposited on Silicon Substrates

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In the present work, the charge transport through films of silica sol-gel deposited on silicon sustrates were studied. The dielectric was deposited on a group of silicon substrates and sintered at several temperatures (400, 500, 600, 800 and 1000 °C). MOS (Metal-Oxide-Semiconductor) structures were fabricated by evaporating aluminum dots on the top oxide through a metal mask. Aluminum on the entire rear silicon surface was also deposited to thickness of 1 mm. C-V (Capacitance-Voltage) technique was used to determine electrical properties at Si - SiO2 interface and I-V (Current-Voltage) measurements were done to determine the mechanism of charge transport in the films. Results from C-V characteristics shown that for samples tempered in N2 atmosphere at T≥ 800 °C, the surface state density was as low as those expected for thermal oxides. I-*vs*-V and I-*vs*-T (Current *vs* Temperature) plots revealed us that for electric fields greater than 3 MV/cm in the oxide, the Poole-Frenkel conduction is dominant for current transport in the films. Under those conditions, the conduction mechanisms are heavily influenced by enhanced thermal excitation of trapped carriers (internal Schottky effect).

DIEI.4

Analysis of the Expansion of Rear and Front-Side Laser Ablation Plasmas

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With transparent target materials it is possible to get both front-side and rear-side laser ablation. Rear-side laser ablation has been investigated as a new configuration for thin film deposition of transparent materials. In order to study the features of this configuration, the analysis of the propagation of laser ablation plumes of the rear and front-side plasmas was performed. The shock wave associated with rear and front-side ablation plumes were recorded by shadowgraphy and the corresponding velocities were determined in each case. We found a spherical wave front in both cases, with the shock wave of the rear-side plasma having a higher velocity. Space and time resolved optical emission spectroscopy was carried out using a gated CCD, in order to identify the excited species present in each plasma and to calculate the kinetic energy of the most important species, by means of time of flight measurements. These two different plasmas were used to deposit SiO_x thin films and compare their properties Experiments were carried using SiO_2 targets and a Nd:YAG laser as the energy source.

DIEI.5

Electrical and Structural Studies on Yttrium Oxide Thin Films in Silicon Substrates at Different Deposition Power

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Yttrium Oxide thin films were deposited by RF-Sputtering technique on etched Si(100) substrates for different surface etching times and deposition power densities. The structure characteristics of films were studied by Grazing Angle XRD, Ellipsometry and AFM. Electrical properties were examinated by C-V measurements. The results showed a relatively good interfacial density of states (aprox. 0.9-3.2 $x10^{12}$ $(cm\ eV)^{-1}$) and relatively good breakdown strength (0.5-2 MV/cm) for these films. Finally, the correlations among morphological, optical and electrical characteristics and the deposition parameters such as deposition power are reported.

* On sabbatical leave from Departamento de Física, CINVESTAV-IPN., México, D. F.
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DIEI.6

Caracterización Eléctrica Mediante C-V y C-t de Dispositivos MIS con Oxinitruros de Silicio Depositados Por LPCVD

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Existe una gran diversidad de métodos para la obtención de películas de oxinitruro de silicio. Una de las técnicas más empleadas es la de fase vapor a baja presión (LPCVD), la cual generalmente consiste de una mezcla de silano (SiH_4), óxido nitroso (N_2O) y amoníaco (NH_3). En este trabajo se utilizaron temperaturas de 700 ºC y 800 ºC para el depósito de estas películas. Para llevar esto a cabo se variaron los flujos de los gases reactantes con el fin de obtener películas con diferentes estequiometrías, es decir, al variar la razón de las presiones parciales del óxido nitroso y el silano (Ro), asi como la razón de las presiones parciales del silano y el amoníaco (R_1), manteniendo constante la presión parcial del amoníaco, se crecieron películas de oxinitruro de silicio, cubriendo el rango de valores de índice de refracción desde el dióxido de silicio hasta el nitruro de silicio (SiO_2-SiO_xN_y-Si_3N_4). Los índices de refracción y espesores de las películas se determinaron por elipsometría, y posteriormente se fabricaron dispositivos MIS sobre sustratos de silicio para su caracterización eléctrica mediante las técnicas C-V (Capacitancia-Voltaje) y C-t (Capacitancia-tiempo). Con relación a las mediciones ópticas, se reportan resultados experimentales tales como velocidades de crecimiento e índices de refracción en función de las condiciones de depósito. En cuanto a la caracterización eléctrica, se presentan los valores obtenidos para la constante dieléctrica, densidad de carga fija en el oxinitruro, velocidad de generación y densidad de estados interfaciales y se establece la correlación entre los parámetros de depósito y los resultados obtenidos.

DIEI.7

Simulación de Curvas C-V y C-t para la Caracterización Eléctrica de Dispositivos MIS

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En este trabajo se presenta el desarrollo de programas en Mathcad para determinar parámetros eléctricos importantes en estructuras metal-aislante-semiconductor (MIS), como es la concentración de impurezas en el semiconductor, la constante dieléctrica y la densidad de carga fija en el dieléctrico, la densidad de estados superficiales en la interfáz dieléctrico-semiconductor (por el método de Therman) y la velocidad de generación superficial. Para la simulación de las curvas C-V se emplearon ecuaciones para la capacitancia en alta frecuencia restringidas al caso en que el atrapamiento de portadores minoritarios por trampas en el régimen de inversión no contribuyen notablemente a la respuesta en AC de dichos portadores. Para la obtención de las velocidades de generación, el método está basado en condiciones experimentales en que el dispositivo es súbitamente cambiado de la condición de acumulación a la de agotamiento profundo, por medio de un pulso de voltaje, obteniendo así la respuesta transitoria C-t. Usando la teoría convencional de capacitores MIS fuera de equilibrio, podemos obtener un conjunto de ecuaciones analíticas, con las cuales los datos experimentales se pueden ajustar por medio de un programa desarrollado en Mathcad, obteniendo de este modo los valores de tiempo de vida de generación y velocidad de generación superficial. Los requerimientos para poder hacer los cálculos, son los datos experimentales tanto de C-V como de C-t, el área del dispositivo y el espesor del dieléctrico. Se muestra que existe una buena concordancia entre los resultados de la simulación y los datos experimentales.

RECI.1

Optical Structural and Paramagnetic Studies of Mn in Sol-Gel Glasses Treated in Oxidant Atmosphere

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In this work are reported the structural, optical and paramagnetic behavior of the Mn incorporated in SiO_2 matrix prepared by the Sol-Gel method. The samples were studied as coatings over slide glassses and in powder form. The powder samples were obtained by the final product of the gelation solution. The samples with Mn concentration among 0.1% w/w to 20%w/w were milled and submitted to thermal treatments among 100ºC to 500ºC. The purpose of study these kind of materials is for obtain coatings with different colors, with the introduction of Mn and submitted at different temperature annealing in oxidant conditions. With the aim of understand the role of the Mn in the color generation of this coatings, was realized the optical, structural, vibration, and the paramagnetic characterization.
The system shows a drastic evolution in the optical properties with the thermal annealing and with the Mn concentration: For low annealing temperatures is observed the presence of nitrates and some oxides precursors of Mn. Up to 5% w/w Mn is resolved the absorption bands due to Mn^{2+} and Mn^{3+}. For higher concentration there is a higher absorption background and the bands are not resolved. This is due to the presence of oxides Mn particles. Aditionally the information obtained by EPR and Raman spectroscopy permit us the determination of the oxidation states of the Mn and the presence of some precursors of Mn oxides.

RECI.2

Recubrimientos Anticorrosivos por la Técnica de Sol-Gel Inorgánico

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Se analizaron recubrimientos de sílice por la técnica de sol-gel inorgánico para su uso como protección anticorrosiva observándose la formación de una barrera al medio ambiente, lo cuál impide el paso del oxígeno ambiental. La adición de diferentes aditivos, tales como $Al(OH)_3$, H_3BO_3, NH_4NO_3, etc., a la estructura de sílice no modifica su estructura amorfa sino que forma un tipo composito en el cuál se ven favorecidas sus propiedades físicas como porosidad, grosor de película, etc. Se tiene un incremento en las E_A de los precursores debido al incremento de oxígenos puente disponible en cada uno de estos materiales. Se utilizó la técnica de RT para conocer los espesores obtenidos vía inmersión de sustratos de cobre acabado espejo en la solución de sílice empleada, lo cuál reporta un espesor cercano a 1.5ìm. Dentro del análisis de especies presentes en la solución, se tiene la presencia de partículas cargadas negativamente al pH de trabajo, con lo cuál tuvo la necesidad de aplicar secado para su completa adhesión al sustrato y un sinterizado a baja temperatura para lograr la consolidación de la matriz. Mediante la técnica de DRX se identificó la presencia de los óxidos de cobre (cuprita y tenorita) así como su evolución a los diferentes tratamientos térmicos empleados.

RECI.3

Desarrollo de Endurecimiento de Superficies por Tratamientos Termoquímicos y Mecanoquímicos

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Es importante enfatizar que las fracturas, por lo general, de un material se inician en su superficie cuando se encuentra en contacto y en movimiento relativo con otro material en determinado medio ambiente. Dependiendo del tipo de contacto, así como de la agresividad del medio se inducirá una fractura en la superficie del material. Así que, si se logra endurecer la superficie del material, se inhibirá el inicio de la fractura. Por tanto, uno de los objetivos primordiales de este trabajo es mostrar una comparación del endurecimiento superficial, empleando las técnicas de tratamiento termoquímico (cementado, nitrurado, borurado) y el tratamiento mecano-químico (Triboacabado). La comparación se obtiene a través de ciertos parámetros tales como : espesor de la capa endurecida, perfiles de dureza y análisis metalográfico.
En nuestro país, existe actualmente una gama de tecnologías utilizadas a nivel industrial en el endurecimiento de superficies en aleaciones metálicas, fundamentalmente aceros, basados en tratamientos termoquímicos como Nitruración, Cementación y Carbonitruración entre otros así como técnicas de depositación química de vapor (CVD), depositación física de vapores (PVD), aplicadas a herramientas de corte. Debido a que cada día se incrementan más las exigencias en cuanto a propiedades tales como: Resistencia al desgaste por abrasión y adhesión, Resistencia al revenido, Resistencia a la corrosión, Acabado superficial, así cono una buena Tenacidad al impacto. Técnicas adicionales de endurecimiento han sido aplicadas a nivel experimental y práctico en nuestro país y en el extranjero en procedimientos de Conformado por deformación plástica tales como: Forja, Extruido y de Triboacabado de superficies.

RECI.4

Deposition and Characterization of Electrochromic DC-Sputtered Nickel-Oxide Thin Films on Different Substrates

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The electrochemistry of hydrous nickel oxide has long been interested due to its role as the active material on nickel battery electrodes and more recently[1,2], there has been a increased interest in the electrochromic behavior of nickel oxide thin films due to its practical and potential applications which include smart-windows in order to achieve balanced lighting and air conditioning levels; these properties are great importance for energy-efficient architecture; other applications are related to anti-dazzling devices for vehicles and to high-contrast nonemissive information displays: from messege boards to highway signs[3].
Electrochromic NiO films were deposited by DC-magnetron sputtering with a water-cooled metallic nickel target (50 mm in diameter, 99.9% purity). Total pressure was 4.0 mTorr of Argon. The films studied here, were grown at room temperature. Also nonstoichiometric nickel oxide films, were deposited by reactive DC-magnetron sputtering.
Our samples were under electrochemical treatment in 0.1 M, KOH solution in order to promove the electrochromic properties [4]. The electrochromism phenomena was induced after a cyclic voltametry process; the cyclic potential range was set from –400 mV to 600 mV at a scan rate of 600 mV/min.The working area of the sample was 2 cm^2. All potentials are reported with respect to SCE.The effects of the different substrates (silica and silica-ITO [5]) on the deposition rate, structural, morphological, electrical and optical properties were investigated in the electrochromics films. Also the electrochromic behavior of our films was studied together with optical spectrum photometric observations in presence of applied DC voltages.The structural and morphological characterization of our films was done by transmission electron microscopy (TEM) in selected area diffraction and bright-field modes. Scanning electron microscopy (SEM) was used to determine surface morphology and topology. We appreciate the financial supports of Projects DGAP IN 109500 and CONACYT 34821E in different stages of work related electrochromic thin films production

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RECI.5

Fabricación y Caracterización de Aleaciones de Ti-Al Por la Técnica de Aleado Mecánico

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Las diferentes composiciones de polvos de Ti - Al, $Al_{1-x}Ti_x$, (x = 5,10,20,30,60,90), fueron mecánicamente aleadas por un molino de bolas SPEX 8000 en una atmósfera de argón con tiempos de aleación de 16 hasta 36 hrs según la composición que se desarrollaba. El proceso de aleado mecánico (AM) permite formar fases amorfas, metaestables, fases sólidas y así como fases de polvos intermetálicos, α - Ti_3Al, γ - TiAl, y $TiAl_3$, estas fases son detectadas por DRX después de un tratamiento térmico aplicado a los polvos. Los intermetálicos tienen las propiedades de ser ligeros, tienen un módulo de elasticidad alto, presentan buena resistencia a la corrosión y son resistentes a altas temperaturas, además de aumentar la dureza al formarse la fase Ti_3Al y TiAl. Los polvos intermetálicos son usados para la fabricación de cátodos por la técnica de PVD. Se presentan resultados de caracterización de las técnicas de difracción de rayos X, microscopía electrónica de barrido, y calorimetría deiferencial.

RECI.6

Silica Gel Crystallization Induced by Silver Crystalline Aggregates

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Low temperature crystallisation of amorphous SiO_2 samples, prepared by the sol-gel method, has been obtained. For that purpose, silver needs to be added to the precursor solution in such a way that it forms aggregates. Silica xerogels samples were prepared with a molar ratio H_2O/TEOS of 11.66 and loaded with silver in three different ways: as chemically synthesised silver fine particles, as silver nitrate and finally as silver chloride. The prepared powder samples were studied as a function of annealing temperature. The microstructure of the silica xerogel powders containing the silver aggregates was studied using X-ray diffraction. Attention was paid to the evolution of both: the precipitated silver into the SiO_2 matrix as well as the glass matrix. At relative low temperatures the silica matrix tends to crystallise independently how the silver aggregates were prepared.
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RECI.7

Películas Delgadas de ZnO:F Depositadas por Rocío Químico: Efecto de la Temperatura de Substrato Sobre las Propiedades Físicas

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Se depositaron películas delgadas de ZnO:F mediante la técnica de rocío químico. Para obtener el compuesto se partió de acetilacetonato de zinc y fluoruro de amonio. El crecimiento se realizó en un rango de temperatura de 450 a 525º C. En este trabajo se reporta el efecto de la variación de la temperatura de substrato sobre las propiedades físicas de las películas. Las películas obtenidas fueron altamente conductoras y transparentes. El valor mínimo de resistividad obtenido fue del orden de $1x10^{-2}$ ohm-cm, para películas depositadas a 475ºC. La transmitancia fue del orden de 80% para todas las condiciones de depósito empleadas. Los estudios de rayos X muestran un crecimiento con una orientación preferencial (002). Del análisis realizado mediante un microscopio de barrido electrónico, se observa que las películas presentan una evidente superficie texturizada.

RECI.8

Influencia de la Temperatura de Substrato en las Propiedades Eléctricas, Ópticas y Estructurales de Películas de ZnO:In Preparadas por Rocío Químico

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La influencia de la temperatura de substrato en las propiedades eléctricas, ópticas y estructurales de las películas de ZnO preparadas por el método de rocío químico ha sido estudiada en este trabajo. Las películas fueron crecidas en un rango de temperatura entre 450 y 525ºC. La solución de partida consistió de pentanedionato de zinc disuelto en una mezcla de etanol y ácido acético a 0.05 M, a la cual se adicionó una solución de cloruro de indio como impurificante. Los resultados de difracción de rayos X y las micrografías de barrido, indican que las películas son policristalinas con superficies texturizadas, teniendo una orientación preferencial en la dirección [101]. Se obtuvo un valor de resistividad mínima de $4*10^{-3}$ Ω-cm y una transmitancia promedio del orden de 80% en la región del visible.

RECI.9

Electrical Properties of Al_2O_3 Thin Films Deposited on GaAs Substrates by Spray Pyrolysis

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Electrical characteristics of high quality aluminum oxide thin films deposited by the spray pyrolysis technique are reported. The films were obtained from the aerosol of a solution of aluminum acetylacetonate in N,N-dimetilformamide on gallium arsenide substrates (100). The addition of an aerosol of water mist during the deposition process resulted in an improvement of the general characteristics of the films. The substrate temperature during deposition was varied from 300 ºC to 600 ºC. The electrical characteristics of these films were determined by capacitance and current versus voltage measurements by the incorporation of these films into metal-oxide-semiconductor structures. The interface states density is in the order of 10^{12} 1/eV-cm^2 and the films can stand electric fields higher than 5 MV/cm, without destructive dielectric breakdown. The determination of the chemical composition of the films was done by EDS, a dielectric constant between 8 and 11 was found. Finally, the study of the surface morphology was carried by AFM.

RECI.10

Development of Ti-Al, Ti-BN and Ti-Al-BN Alloys by Mechanical Alloying

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The Metal Mechanical Industry (MMI) always requires a great variety of cut tools that are made of specials steels. The development in the melting process and refining, not are enough to obtain good results and to increase the production levels in the Industry. Additionally, the quality in the machining products is an immediate condition of attention. All the cut tools should provide good conditions in the finish surface and geometry of the pieces manufactured. In the 90's, the research and development in ceramic coatings and thin films using some physical vaporization techniques have come to increase the mechanical properties and wear resistance of cut tools, reducing the manufacturing cost and improvement the quality product. The Physical Vapor Deposition technique (PVD) is normally employed to obtain coatings of nitrides of titanium, aluminum and boron, in some cases it is required to obtain nitrides of a mixture of titanium - aluminum or titanium boron. This coatings have high values of wear resistance, surface hardness, mechanical resistance at high temperature, and of electric and thermal conductivity. Due to the melt point differences between titanium and aluminum, and between titanium and boron, it is not possible to obtain targets for PVD systems made by using alloys of this elements by conventional methods. Frequently, these targets are made by a simple mixture of powder of these metals and no from alloys. In this work we are proposing to use the Mechanical Alloying (MA) technique to obtain Ti-Al, Ti-BN and Ti-Al-BN alloys with a nanometer particle size and make coatings to make targets for the PVD technique.

RECI.11

Recubrimientos Fotocrómicos sobre Sustratos Corning por el Proceso de Sol-Gel

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Mediante la técnica de sol-gel y una reacción de sustitución metálica entre nitrato de plata 0.4 N y un gramo de limaduras de cobre , se obtuvieron recubrimientos de sílice con partículas de plata dispersas dopadas con cobre, estos se sometieron a tratamientos térmicos a 500° C Variando el tiempo de estancia a 30 minutos, 1hora, 2 horas y 4 horas. Las partículas de plata y cobre le confieren propiedades fotocrómicas al recubrimiento depositado sobre sustratos de vidrio Corning. Los difractogramas de Rayos X revelan la presencia de fases cristalinas de cuarzo y cristobalita a 800° C, al introducir estas partículas de plata y cobre a la matriz de sol-gel. Los recubrimientos al término de tratamiento térmico presentan una coloración amarilla, al permanecer en la oscuridad o a la sombra, se tornaron transparentes y al exponerlos a la luz solar retornaron a la coloración amarilla presentándose el efecto fotocrómico, los espectros de UV/VIS muestran el efecto fotocrómico e estos recubrimientos

CMI.1

Impedance Spectroscopy Studies on Chemically Deposited CdS and PbS Polycrystalline Films

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Room temperature impedance spectroscopy measurements on chemically deposited CdS and PbS films were performed using the "sandwich" geometry. The experimental data for both materials represented by the complex plane diagrams showed two well-defined semicircles. The results were analyzed in terms of the "brick-layer" model, appropriate for polycrystalline materials in which the crystallites and its boundary are well developed. According to this model, the equivalent circuit which best represent the polycrystalline films, consists of two RC circuits connected in series, one representing the grain and the other the grain boundaries. By fitting the spectral response of the equivalent circuit to the impedance measurements, electrical and structural parameters were obtained. The calculated structural parameters agree with those obtained using atomic force microscopy measurements.

CMI.2

Numerical Study of Oxide Thin films Growth using IV Laser Beam

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Similary to one model developed by ourselves and which was already published, we study the spatial simulation of the tridimensional geometry and the growth ratio of TiO_2 thin films. The thremo-oxidation process of Ti films, deposited over glass substrate, is due to the surface heating while it moves at constant speed in the presence of a intense IV-infrared beam of a pulsed Nd:YAG laser at open air. The computational algoritm used for the calculations in this model takes into account adecuate autoconsistent concepts like retroalimentation on the initial values of the heating parameters. This retroalimentation process leads to formation of Ti oxide traces. The theoretical estimations of the film thickness and the growth ratio shows excelent concordance with respect to the mesured experimental values.

CMI.3

Medición de Diámetros de Haces Gaussianos por Medio de la Energía Difractada Normal a la Pantalla en Rejillas Aperiódicas

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Proponemos el uso de la energía difractada en la dirección normal a la pantalla por rejillas aperiódicas calculada con la teoría escalar de Rayleigh-Sommerfeld, en la medición de diámetros de haces gaussianos. Usando el cociente de la energía difractada en la dirección normal a la pantalla en posiciones de mínima y máxima potencia en rejillas aperiódicas mostramos que se pueden extender los rangos de caracterización de haces Gaussianos en comparación con los resultados obtenidos con el mismo coeficiente en rejillas periódicas[1].

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CMI.4

Difracción Rigurosa de Haces Hermite-Gauss por Dos Rendijas: Acoplamiento Entre Rendijas

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Se presenta una teoría rigurosa de la difracción para la incidencia oblicua de haces Hermite-Gauss sobre una pantalla de espesor h, con dos rendijas de ancho ℓ y separación d. Los haces inciden con polarizaciones TM y TE. Analizamos numéricamente la incidencia normal y oblicua en el coeficiente de transmisión en función de la separación d entre las rendijas. Hemos encontrado para haces extremadamente anchos a incidencia normal que el coeficiente de transmisión presenta oscilaciones con periodo l en función de la separación d para los modos m=0,2,4. Para incidencia oblicua a 30º estas oscilaciones tienen un periodo $1.8\,l$.

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CMI.5

Resonancia Paramagnética Electrónica de Zeolitas Cubanas

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Estudiamos por Resonancia Paramagnética Electrónica (EPR) a Zeolitas naturales del yacimiento de Caimanes de la provincia de Mou, Cuba. Las mediciones EPR se tomaron a 300 y 77 K. Los espectros EPR a 300 K presentan una señal muy ancha simétrica en g = 2.1. Y en los espectros a 77 K el g de la señal ancha simétrica pasa a un g = 2.2, aumentando ligeramente su intensidad, a esta temperatura aparece una débil señal en g = 4. Hemos observado que estas señales EPR son independientes del tamaño de grano. Atribuimos la señal en g ≈ 2.2 probablemente a iones Fe^{3+} bajo espín (S=1/2), principalmente en sitios octahédricos cuyos compuestos forman parte de los poros y canales de la zeolita. La pequeña señal que aparece a la temperatura del nitrógeno líquido pertenece a iones Fe^{3+} alto espín (S=5/2) en sitios tetraédricos distorsionados, incorporados en la red cristalina de la zeolita.

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CMI.6

Implementación de un Sistema para Medición de la Conductividad Térmica a Alta Temperatura de Polvos Aislantes Térmicos Basado en Flujo de Calor Radial en Estado Estacionario

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Presentamos el diseño e implementación de un sistema basado en el flujo de calor radial en estado estacionario, el cual es utilizado para determinar la conductividad térmica de polvos aislantes térmicos. Dicho sistema es una modificación de la norma D2858-(70-90) de la ASTM. Uno de los beneficios del sistema es poder utilizar cantidades pequeñas de muestra (aproximadamente 30 gr.), mientras que el sistema D2858-(70-90) de la ASTM utiliza cantidades de muestra de aproximadamente 150 gr. Así mismo la automatización del sistema usando computador es una de las principales ventajas de nuestro sistema, debido a que reduce significativamente el error en la medición. Para las pruebas y calibración del sistema se utilizaron polvos de óxidos de magnesio de uso industrial.

CMI.7

Efecto de la Microestructura y Composición Química en la Conductividad Térmica de Óxidos de Magnesio de Uso Industrial

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Reportamos un estudio del efecto de la microestructura y la composición química en la conductividad térmica de polvos de óxidos de magnesio de uso industrial. El análisis de microestructura y composición química fue realizado usando DRX y EDS-SEM respectivamente. La medida de la conductividad térmica fue realizada usando la técnica de flujo de calor radial en estado estacionario a altas temperaturas, en un rango de 200 a 900 ^{o}C. Nuestros resultados de conductividad térmica para los polvos de MgO de uso industrial, muestran una relación directa, es decir se incrementan con la temperatura. El estudio por DRX, revela la existencia de dos fases principales en las muestras, una correspondiente a MgO tipo Periclase, y otra de Zircon ($ZrSiO_4$). Esta segunda fase se encuentra principalmente en las muestras con tamaño de grano menores a 250 μm.

CMI.8

Structural Characterization of CdS_xTe_{1-x} Thin Films

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Thin films CdS_XTe_{1-X} structures were grown on corning glass substrate by the close space vapor transport combined with free evaporation technique (CSVT-FE) using coevaporation of CdTe and CdS. The substrate and CdTe source were kept at constant temperature. In order to prepare samples with different concentration of sulfur the CdS source temperature was varied. Optical properties were determined using a Perkin Elmer LAMBDA 40 UV-vis spectrophotometer. The gap energy of the samples show a variation associated with the change in the CdS source temperature. X-ray diffraction measurements were performed with an AXS-BRUKER D8 diffractometer fitted with a Cu anode. Samples structural characterization shows the variation on lattice parameter and changes of phases both related with the CdS source temperature.

CMI.9

Cathodoluminescent and Photoluminescent Properties of Praseodimium Doped ZrO_2 Powders Prepared by Coprecipitation Technique

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Praseodimium doped ZrO_2 cathodoluminescent and photoluminescent powders have been prepared by coprecipitation process. Different furnace temperatures and times, doping concentrations were studied. It is observed that the crystallinity of the powders depends on the annealing temperature and time. For furnace temperatures lower than 400°C and times about 3 hours, the powders are amorphous, whereas for annealing temperatures higher than 400°C and times about 1 ½ hours the crystalline structure of the prepared material presents the metastable monoclinic and tetragonal phases. Preliminary measurements on cathodoluminescent emission are presented. In the case of photoluminescence, the excitation and emission spectra were obtained; for an excitation wavelength of 274 nm, all the photoluminescent spectra show peaks located at 565nm, 616nm, 645nm and 710nm. Concentration quenching of the cathodoluminescence and photoluminescence are presented.

CMI.10

Characterization of Ion Implanted Silicon Wafers by Photothermal Radiometry

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B^+-implanted silicon wafers with three different implantation energies (500, 750 and 1200 KeV) have been studied by 3D-Photothermal Radiometry[1]. Four points in each side of the wafers were chosen. It was possible to determine by the PTR metroly the influence of the implantation energy in the thermal and electronic transport parameters. We found that when the implantation energy increases the front surface recombination decreases as well as the thermal diffusivity values.

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CMI.11

Study of the Recombination at SnO_2 /Si Interface

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Using the open photoacoustic (PA) cell technique we study the passivation properties of chemically sprayed SnO_2 on silicon surfaces. The values of surface recombination velocity at the Si/SnO_2 interfaces were obtained by fitting the experimental data to the calculated theoretical PA signal which includes all the different recombination mechanisms in the samples. The dependence of this parameter on the growth temperature of the samples is presented. Optimum SnO_2 films on silicon substrates were obtained at 300 ^{0}C with recombianation velocities below 2×10^2 cm.s^{-1}.

CMI.12

Si Out-Diffusion in C/Si and CN_x/Si Deposits Grown by Laser Ablation

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This work presents some results concerning Si out-diffusion in C/Si and CN_x/Si films grown by laser ablation. The composition and concentration profiles of these samples, including H, were obtained by Elastic Forward Analysis. Some CN_x films, depending of the N_2 pressure used during the growth, incorporate appreciable amounts of H and O. These samples, compared to the CN_x deposits without H and O as well as to the C ones, show a greater concentration of Si, whose distribution, as well as that of H and O, is approximately homogeneous. Additionally, some samples were annealed at fixed temperature and for different times, in air or vacuum. In these cases, our results indicate a greater Si out-diffusion in air than in vacuum, as well as in CN_x/Si containing O and H compared to C/Si.

CMI.13

Quality Determination of Commercial Automotive Oils by Laser Light Scattering

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Quality determination of commercial oils is related to their degradation as function of temperature. A monotonic decrease in the intensity of the scattered light as the oil temperature increase, was achieved. Different fitting of these curves were found for each commercial oil. Temperature measurements were made with an optical pirometer at the same time. Change in LLS signal, has been related to Viscosity and chemical changes of the oil. We have demonstrated the sensitivity of laser light scattering technique to determine critical temperature to prevent lubricant degradation. A Quality parameter has been defined by means of a numeric fitting model. Potential applications to monitor quality of machine lubricants at real time has been demonstrated.

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BIO.1

Determination of Thermal Diffusivity in Pure and Mixtures of Edible Comercial Oils, by Thermal Lens Spectroscopy

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In this work is determined the themal diffusivity of several edible comercial oils using thermal lens spectroscopy. Is analized the thermal diffusivity between the mixture of edible oils Soya and Canola (samples with lowest and highest thermal diffusivity values respectively). The thermal diffusivity behaviour in the Soya and Canola oil as a functions of the temperature, show a similar trend as the enhancement factor of the absorption coefficient. The soya oil shows an increasing behaviour and for the canola oil the behavior of these parameters is in the opposite direction. The optical absoption spectra of these oils show significant differences in the ultra-violet region of the spectrum.
The aim of this work is determine the sensitivity of the physical parameters, as the thermal diffusivity or the enhancement factor of the absorption coeficient , when a pure comercial oil is adulterated with other edible oil.

BIO.2

Differential Scanning Calorimetry of Biopolymers Amylose and Amylopectine

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Amylose and amylopectine do not exist free in nature, but as component of discrete, semicrystalline aggregates called starch granules. The starch used in this work has been obtained at CICATA laboratories by means of the fractionated milling process. When purified corn starch granules are heated in the presence of limited amount of water, two endothermic transitions are observed by differential scanning calorimetry (DSC). The lower temperature endotherm is always observed at fixed temperature, it is the only endotherm observed when excess water is present. The higher temperature endotherm is observed at increasing temperature as the water content is decreased. The shift of the higher temperature endotherm is interpreted as the lowering of the melting point of starch crystallites by solvent water. These phase transitions of starch are explained using the Flory theory. Furthermore, on the basis of X-ray crystallography, detailed structural analysis of amylose, amylopectine and starch are reported. The X-ray spectrum of the starch obtained by the fractionated milling process is similar to that of the spectrum of the starch type A reported in previous experiments.

BIO.3

Microporous Ceramic Membrane

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The permeation is a physical process for the separation of substances in similar or different aggregation states, this includes molecular level. Porous ceramic membranes are utilized by some permeation systems, these have variable pore size and classification in; mesoporous, microporous and nanoporous.
In this work two different deposition techniques; compression and simple impregnation, for microporous membrane of Al_2O_3-α are described. The membranes were deposited on interior walls of the monolithic tubular support orifices. Al_2O_3-α powders (ALCOA A12) , methocell and ionized water. After, the layer is dried and sinterized. The support is fabricated with commercial feldspar by vertical direct extrusion. The membranes obtained by compression have an uniform depth around of 50μm. Results of permeation experiments, optical and electronic microscopy and porosity measurements are shown.

BIO.4

Análisis de la Topografía de Superficie de Geles de Mucina-Grenetina

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La mucina es una glicoproteína que se obtiene comercialmente del estómago del cerdo. Tiene propiedades funcionales asociadas a su localización en estructuras epiteliales y en el estómago protege a la mucosa de la acción erosiva del ácido gástrico. El objetivo de este trabajo fue determinar la estructura superficial de geles de mucina cruda y purificada y evaluar los cambios por la adición de grenetina, mediante microscopía de fuerza atómica. Se desarrolló un proceso para la elaboración de los geles de ambas mucinas, preparados al 8 % en presencia de $CaCL_2$ a temperatura de 60 y 70 ºC, con períodos de reposo (4 hr) y agitación (10 min a 1 hr), a diferentes tiempos, para la adición de grenetina. Los resultados obtenidos mostraron para los geles de mucina cruda sin grenetina, una superficie uniforme con ligeras protuberancias y puntos negros que se interpretaron como depresiones producidas durante el proceso de gelificación. El patrón de comparación fue un gel de grenetina, el cual presentó una superficie homogénea poco diferenciada. Los geles de las mezclas de mucinas cruda o purificada con grenetina, presentaron en general, una estructura superficial más grumosa con protuberancias; también se observaron poros y depresiones. Sin embargo, el gel de mucina purificada mostró una estructura superficial más homogénea y regular, por lo que se infiere que las impurezas de la mucina cruda interfieren en la topografía del gel.

BIO.5

Formación de Microcápsulas Usando Pectinas de Tuna Y Galactomananos de Mezquite

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Actualmente, en la industria alimentaria se ha dado una mayor importancia a la formación de biopelículas empleando polímeros naturales, con la finalidad de encapsular ingredientes alimenticios como sabores, vitaminas y otros nutrientes esenciales. Los hidrocoloides representan una opción interesante para utilizarse como agentes encapsulantes debido a que poseen propiedades espesantes, estabilizantes, emulsificantes o gelificantes, cuando están dispersos en agua. El principal objetivo de este trabajo fué obtener y caracterizar microcápsulas formadas por pectinas procedentes de cáscara de tuna y por galactomananos de semilla de mezquite, tomando como modelo de estudio la encapsulación de oleorresinas de apio. Inicialmente, se realizó la formación de emulsiones y se determinó densidad relativa, tensión superficial (Surface tensiometer 2141), pH (pHmeter Oakton) y se evaluó el comportamiento al flujo (Viscosímetro Haake RV2) y la estabilidad bajo condiciones de temperatura. Posteriormente, la formación de microcápsulas se llevó a cabo mediante la técnica de secado por aspersión (Niro Atomizer) y se determinó actividad de agua (a_w), humedad relativa (Thermoconstanter RTD33) y rendimiento de encapsulación. Los resultados indican que las pectinas y los galactomananos utilizados proporcionan una mayor estabilidad en las emulsiones y cápsulas en comparación con goma arábiga y con pectinas cítricas comerciales.

BIO.6

Películas Comestibles como un Método de Conservación de Frutos

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El desarrollo de biopelículas comestibles que limiten la transferencia de vapor de agua y permitan una transferencia selectiva a gases, para la protección y conservación de frutos y vegetales, es una tecnología altamente deseable en la industria de los alimentos. En este trabajo se propone el uso de polisacáridos como Carboximetilcelulosa (CMC) y quitosana (QUIT) a diferentes concentraciones (0.1, 0.25 y 0.5%) para su aplicación sobre carpóforos de Pleurotus spp. En primer lugar, se realizó la caracterización reológica (Viscosímetro Haake RV2) de las dispersiones de estas mezclas de polímeros. Posteriormente, los carpóforos recubiertos fueron monitoreados en términos de actividad de agua -a_w- (Thermoconstanter RTD33, TH2 Novasina), peso (Balanza semianalítica OHAUS) y tasa respiratoria (Cromatógrafo de gases Perkin-Elmer) durante su almacenamiento a temperatura ambiente (25 ºC). Las dispersiones que presentaron las mejores características para aplicarse como recubrimiento en base a su viscosidad y transferencia de CO_2 , fueron CMC y QUIT al 0.25%, así mismo conservaron el peso y la a_w del carpóforo, incrementando su vida útil a 5 días.

BIO.7

Estudio de la Distribución de Protoporfirina IX Inducida en Piel de Ratón Mediante Técnicas Fototermicas

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En este trabajo se estudia la distribución de la protoporfirina IX (PpIX) en tejido (piel de ratón) así cómo efectos colaterales y mejoramiento de la terapia fotodinámica. Mediante la aplicación de espectroscopia fotoacústica (EFA) y el método de separación de fase presentamos el análisis de espectros en pieles de ratón femenino CD1, divididos en dos grupos de 7 cada uno. Al primer grupo se inoculo con acido δ-aminolevulinico (ALA) vía intraperitoneal. Este ácido es utilizado en terapia fotodinámica, ya que induce a la generación de la PpIX. Las muestras del segundo grupo fueron inoculados con solución salina. Los resultados que hemos obtenido indican que la PpIX se encuentra ubicada próxima a la cara interna de la membrana basal. Este es un resultado novedoso e importante en el estudio de la terapia fotoadinámica. Además reportamos que el coeficiente de absorción óptica máximo para la piel de ratón es 630nm y mostramos el fotoblanqueamiento de la PpIX.

BIO.8

Aplicación de un Método Fototérmico al Estudio de la Permeabilidad al Vapor de Agua de Bio-Películas en Diferentes Humedades Relativas

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El presente estudio esta enfocado a la determinación de la permeabilidad al vapor de agua de bio-películas de pericarpio de maíz sometidas al proceso de nixtamalización tradicional. El conocimiento de la permeabilidad al vapor de agua bajo diferentes humedades relativas es importante porque nos da información del grado de humedad en el interior del grano para diferentes humedades relativas en condiciones en las cuales el pericarpio ha sido parcialmente degradado, en este caso por el proceso de nixtamalización. El pericarpio fue obtenido de granos de maíz nixtamalizados con una concentración de cal al 1% respecto al peso del maíz. Estos pericarpios son sometidos a diferentes humedades relativas y su coeficiente de difusión al vapor de agua es determinado por una configuración fototérmica recientemente propuesta.

BIO.9

Static Magnetic Fields Effects in Peripheral Blood Mononuclear Cells

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The role of electromagnetic fields in the generation of Ca2+ currents in peripheral blood mononuclear cells (PBMC) is described. The sensitivity of *Ca2+* channels and pumps to membrane potential and ion con-centration were considered in a method *that* uses the conductivity as a dynamical coefficient in the Onsager's reciprocity relations, and the dynamics of the calcium ions described by- the electrodiffusion equation deduced by Pelce.
The enhanced influx of calcium ion in PBMC was studied parametrizing the static magnetic fields effects through the conductivity by the coefficients γ, ρ and κ. The parametrization was made according to the symmetry properties of Onsager's reciprocity relations using the most simple expressions. From experimental data and physical considerations concerning to PBMC, was obtained the order of magnitude for the value of $\rho \cong O(-10^{5}\ mol/(Vm^{2}s))$, $\kappa = 0$, $\gamma \cong O(-10^{-3}\ moll(VT^{2}m^{2}s))$. With this parametrization, the time to induce calcium current in the cell was always less than the situation without magnetic field application.
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Octubre 1 al 5, 2001

BIO.10

Chemical Insertion of Heterocyclic Luminescent Chromophores to Polystyrene via Free Radical Copolymerization

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Polymerizable heterocyclic chromophores maleiperinone and norbonilenperinone were obtained using a novel low temperature synthetic approach. This catalytic synthesis method allowed functionalizing these chromophores by incorporation of a double bond potentially active in polymerization reactions. The chromophores showed high extinction coefficients of ε=6300 lt mol^{-1} cm^{-1} at 480 nm and ε=4500 lt mol^{-1} cm^{-1} at 331 nm, for maleiperinone and norbonilenperinone respectively. Maleiperinone was found to be copolymerizable with styrene via free radical reaction of the double bond The copolymers with up to 6% by mole of the chromophore were obtained using either solution or bulk polymerization. Weight average molecular weight by GPC ranged from 40,000 to 140,000 and it decreased with an increase of the chromophore content. No notable change in glass transition temperature was detected within the resolution of DSC or TMA methods. Polystyrene modified via chemical insertion of the fused heterocyclic chromophore exhibited an absorption maximum at 331 nm, which was consistent with the absorption of a model compound succinilperinone. Intense photo-emission in the visible region (442 nm and 460 nm) was also observed for the copolymers obtained when they were irradiated with UV light with wavelength of 262 or 335 nm.

BIO.11

Determinación de Efusividad Térmica en Hueso Denso y Metales de Uso Biomédico

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Presentamos un estudio de la efusividad térmica en hueso dense de res en dos diferentes cortes y su comparación con los resultados que hemos obtenido para la efusividad térmica de metales de uso biomédico, come son el titanio de alta pureza y el acero inoxidable 316L En las mediciones de efusividad térmica utilizamos la técnica fotoacústica en una configuración de difusión de calor en un sistema automatizado. Nuestros resultados muestran que en ambos metales la efusividad térmica tiene un valor parecido, y del orden de magnitud que el valor correspondiente a las muestras de hueso denso. Por consiguiente, la capacidad de intercambio térmico entre estas muestras es muy buena, lo cual indica una buena compatibilidad térmica entre estos metales, frecuentemente utilizados en implantes, y el tejido óseo. La diferencia encontrada entre la efusividad térmica de hueso en polvo compactado con la de las muestras de hueso en sus dos cortes, muestra la dependencia de las propiedades térmicas con la microestructura del material.

BIO.12

Photoacoustic Measurements of the Effects of Biologist Microorganisms Over the Photosynthesis of Tomato Cultures

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The aim of this work was study the effects of the plant pathogenic fungus *Fusarium oxysporum*, responsible of the radicle rot in Tomato cultures on photoacoustic signal, and the effect of *Pseudomonas* bacterium isolates as an antagonist pathogenic microorganism. Of a sample of 64 tomato plants were prepared 4 repetitions with 7 different types of *Pseudomonas* bacteria, as well as the combination of all of them, in ground without fungus and ground infested with the fungus *Oxysporum fusarium*. Were realized photoacoustic measurements of photosyntetic signal of the plants *in vivo* and *in situ*. We found a difference between 15 and 20 micro Volts of signal magnitude between those plants prepared with benefic bacterium and the effects of ground infected with pathogenic fungus. Also we found that the intensity of the photoacoustic signal changed around of 5 micro Volts with the particular type of *Pseudomonas* bacterium. A quantitative analysis that consists of considering the photoacustic signal like the variable vectorial sum in the time, allow us to separate thermical contribution of that produced by the evolution of photosynthetic oxygen, and to estimate the oxygen concentration generated by leaves during this process.

BIO.13

Study of Dehydration Processes in Porous Media: The Effect of the Steeping Time on Structural Properties of Instant Corn Flour

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The dehydration process was carried out a using simultaneously two precision balance. The sample was placed onto a structure that contained a metal screen in the chamber of a digital balance, A dehydration agent (silica gel, 27 ^{o}C and 35 % relative moisture) was placed into the closed chambers to remove excess moisture. We study the kinetic of dehydration process in instant corn flour prepared by nixtamalization process as a function of the steeping time and the results were correlated with viscosity values obtained for the same set of samples. According to these results there exist samples with high viscosity values that remain water indicating a partial destruction of the starch granules or a mixture composite (granules and macro molecules). In this way it is possible to determine if high values of viscosity correspond to integer grains or a mixture. Also we study the dependence of the dehydration curves as a function of particle size in systems with chemical and mechanical contact.

BIO.14

Effects of the Post-Cooking Steeping Time on the Structural and Rheological Properties of Nixtamalized Corn Flour

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In this work we study the influence of the steeping time on the structural and rheological properties of maize flour prepared by the traditional nixtamalization process as well as under calcium ion over-saturated conditions. The calcium content of the corn flour was measured by atomic absorption spectroscopy and was correlated with X-ray diffraction, viscosity, and pH measurements. According to the experimental results, the steeping of the alkaline-cooking maize kernel allows the calcium ions diffusion into the kernel, producing important changes in the structural and rheological properties of the instant corn flour. The series of experiments carried out in this work is of importance for the tortilla industry because it establishes for the first time from a physics point of view that the corn flour with the best structural and rheological properties to prepare fresh masa to make tortillas is obtained with a post-cooking steeping time of between 7 and 9 hours.

BIO.15

Diffusion of Calcium into Maize Kernels During the Nixtamalization Process

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In this work we report the measurements done on the penetration of calcium ions into whole maize kernels during the traditional nixtamalization process: cooking and steeping. The measurements were done using radioactive calcium-45 tracers and atomic absorption spectroscopy. The findings shows little penetration during the cooking time limited to the pericarp, the outermost layer of the endosperm and the interface between the pericarp and the germ. During the steeping time calcium penetrates preferentially thought the tip cap and the interface between the pericarp and the germ. After cooking we found 0.546 % of calcium in the pericarp, 0.058 % in the germ and about 0.021 % in the whole endosperm and a more detailed measurements in the outermost 10% of the endosperm showed a concentration of 0.065 %. After 18 hours of steeping the corresponding calcium concentrations were: 2.131 % in the pericarp, 0.653% in the germ and 0.177% in the whole endosperm and 0.341 % in the outermost 10 % of the endosperm. This is the first time that the penetration of calcium in corn kernels due to the nixtmalization process has been studied qualitatively and quantitatively simultaneously.

BIO.16

Photoacoustic Study on the Kinetics of Protoporphyrin IX in Mice Skin

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Photodynamic therapy (PDT) has become a successful method in the treatment of cancerous tumors. This therapy consists in the administration of a photosensitizer in a patient, followed by an exposition of the subject to light of appropriate wavelength[1]. Reactions taking place in the tumor as a consequence of the light-photosensitizer-tissue interaction ultimately lead to a complete or partial tumor regression. Porphyrins have been widely used as photosensitizers in the photodynamic therapy of cancerous tumours[2]. In this work, the kinetics of Protoporphyrin IX (PpIX) production in mice skin, induced by the administration of δ-aminolevulinic acid, is studied by photoacoustic spectroscopy.

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POL.1

Determinación de la Difusividad Térmica de Sol-Gel con Incorporación de Mn Durante el Proceso de Gelación por Espectroscopia de Lente Térmico

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La determinación de los parámetros de transporte térmico en materiales es un área importante en la caracterización de los materiales y su correlación con propiedades como estructura y composición, además de que el conocer con exactitud éstos parámetros permite tener una mejor idea de las aplicaciones de éstos en situaciones aislantes o de disipación de calor. Dado que estos parámetros son fuertemente dependientes de la estructura y composición del material, ofrecen la posibilidad de monitorear evolución estructural y transiciones de fase durante procesos dinámicos como la gelación, para lo cual la espectroscopia de lente térmico ofrece la facilidad de determinar la difusividad térmica del sistema sin alterarlo.
En nuestro caso el sistema estudiado es Sol-Gel con incorporación de metales específicamente de manganeso. Los componentes de este Sol-Gel son: TEOS (tetraetilortosilicato), etanol, agua destilada, catalizador (ácido nítrico al 5%) y el metal incorporado como nitrato de manganeso ($Mn(NO_3)_2$) a diferentes composiciones: 0.1, 0.2, 1, 2, 5, 10, 15 y 20 % en peso. Desde su preparación cada solución de Sol-Gel se estudia por espectroscopía de lente térmico. Cuyo principio fundamental es hacer incidir en la muestra un láser de excitación (Ar) que tiene un perfil de intensidades de tipo gaussiano, la cual se coloca en la cintura del láser de excitación. Parte de esta radiación electromagnética es absorbida por la muestra y convertida en calor se induce una variación radial de temperatura en ella, lo que también induce una variación en el índice de refracción. Así cuando incidimos un láser de menor potencia llamado láser de prueba (He-) Ne) este sufrirá una convergencia o divergencia; en nuestro caso el láser experimenta una divergencia al pasar por la muestra. Por medio de un fotodiodo se mide la intensidad en el centro del haz de prueba en el campo lejano y el transiente originado por el efecto de lente térmico es registrado por un osciloscopio y después a una pc.
Mediante un ajuste a los datos experimentales de la intensidad en el centro del laser de prueba en función del tiempo se obtiene la difusividad térmica y el factor de aumento del coeficiente de absorción del sistema estudiado
El objetivo principal de este trabajo es correlacionar la evolución de las propiedades estructurales del Sol-Gel, con el comportamiento de la difusividad térmica del sistema y el factor de aumento, el cual incluye la evolución de la variación del camino óptico. Este último depende del índice de refracción y de propiedades mecánicas del medio como son el coeficiente de expansión lineal, el módulo volumétrico y la razón de Poisson, además de la polarizabilidad del medio. Estudios adicionales como difracción de rayos-X y mediciones de viscosidad, se realizarán para obtener una mejor comprensión de la evolución de este sistema y la influencia del metal de transición utilizado.

POL.2

The Organic Dyes Confinement in Organic and Inorganic Hosts and the Effect in their Degradation

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The entrapment of dye molecules in solid host matrices is an alternative to the dye lasers that offers vantages but also implies disadvantages against the liquid solvent dilutions commonly used, which have static, solvent evaporation or flowing of lasing dyes. The organic dyes are generally inferior to a transition metal ion due to its photochemical and thermal instabilities but they are cheap, safe in handle, and there are thousands which permits all kind of tonalities. The organic dye host matrices were of silica prepared by the sol-gel technique, PMMA and an organic-inorganic hybrid material (OIHM). The OIHM is composed of a mixture of SiO_2 and an acrylic copolymer with properties of both systems. The absorption spectra of a rhodamine dye show an unusual intense band at a wavelength of 310 nm when it is embedded in the PMMA matrix. A band in this position is desirable for exciter laser applications, which emit at 308 nm. The degradation of dye molecules can be separated in two main factors; the electronic transference between dye molecules and their oxidation. The influence of the different matrices in the degradation factors were analyzed and the stabilities observed treated in terms of a simple two dimensional quantic model.

MS.1

The Vanadium Surface Magnetism

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Experiments by Rau and co-workers gave a magnetic moment in the V(001) surface. Freeman realized an ab-initio calculation and got that is not magnetic. Recently García-Cruz and co-workers showed that the ideal V(100) surface is not magnetic, but an isotropic expansion of the lattice by as few as 0.4% from theoretical value is enough to produce a magnetic moment. We extend the calculation to the others direction like (110) and (111). In this work, we first explore with a tight-binding model the effect of the difference of 5 % on the theoretical lattice parameter as compared to experiment. In the second part, we look at the effect that the contraction of the first interlayer distance has on the electronic structure at the surface.

MS.2

Magnetic Moments of a Pair of Cr_4 Atomic Clusters Embedded in Bulk Fe in Terms of the Spatial Orientation

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The local magnetic moments μ_i of a pair Cr_4 atomic clusters embedded in bulk Fe are determined by using a realistic *spd*-band Hubbard-like Hamiltonian. The spin density distribution is calculated self-consistently in the unrestricted Hartree-Fock approximation and the μ_i are obtained at various atoms *i* of the cluster and of the surrounding matrix. We consider two different orientations between the clusters; the axis of symmetry of the clusters are collinear (C) and non-collinear (NC), for all the cases studied we compare these results with the results to just one Cr_4 atomic cluster embedded in bulk Fe; the interface magnetic coupling between clusters and matrix moments does not change, the alignment is anti-parallel, but the μ_i of Cr are changed by the presence of other identical cluster and these values depend of the spatial orientation between the Cr clusters [*e.g.*, $\mu(2)$= -1.13 μ_B for NC, $\mu(2)$= -1.30 μ_B for C and for just one Cr_4 atomic cluster $\mu(2)$= -1.33 μ_B], in the most of the cases the Fe moments close to the cluster are reduced [*e.g.*, $\mu(3)$= 1.73 μ_B for NC and $\mu(5)$= 1.98 μ_B]. Remarkable proximity effects are also observed at the interface clusters-matrix as the distance between the clusters is increased; the magnetic order within the clusters does not change for the presence of other cluster with the same symmetry, it is ferromagnetic.

MS.3

Synthesis of g-Fe_2O_3, a-Fe_2O_3 and $Ni_{0.5}Zn_{0.5}Fe_2O_4$ Particles Embedded in a SiO_2 Matrix

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Using X-ray diffraction and IR absorption spectroscopy we report a study of the formation of particles of iron oxide and Ni-Zn ferrites embedded in a xerogel SiO_2 matrix. Initial solution were prepared mixing TEOS, distilled water, ethanol, and four different nitrates: iron, barium, nickel and zinc. A molar ratio H_2O:TEOS:Et-OH of 11.66:1.0:4.0 was used in all solutions. Formation of maghemite (γ- Fe_2O_3), hematite (α-Fe_2O_3), and $Ni_{0.5}Zn_{0.5}Fe_2O_4$ as well as structural modifications of the SiO_2 matrix induced by these particles are discussed.

MS.4

Evidence of Magnetic Amelioration of Scale Formation

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The build up of scale deposits is a common and costly problem in many industrial processes using natural water supplies. This problem consist in the poor thermal conductivity of scaled surfaces: heat transfer is decreased by 95% by a $CaCO_3$ scale layer 25 mm thick (1), whereas an SiO_2 scale layer 0.5 mm thick results in a 90% decrease in heat transfer (2).
Antiscale magnetic treatment has a long and controversial history (3). In this work, the influence of a magnetic treatment on the structure of the scale is studied. The device used consists in allotropic cells (4) immersed in water. XRD of the scale obtained from treated tap water reveals an enhance of the crystalline domains in an amorphous background, which is softer and less tenacious than the scale without treatment.

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MS.5

Synthesis and Characterization of $TlBa_2Ca_2Cu_3O_x$ Thin Films Grown on Texturized Silver Substrates

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Among high T_C superconductors suitable for power applications in transmission of energy as well as in superconducting magnet systems, the $TlBa_2Ca_2Cu_3O_x$ (Tl-1223) system appears to be very promising because of intergrain connectivity and relatively good magnetic flux pinning. In this work we present preliminary results on the synthesis of thin Tl-1223 films grown on texturized silver (Ag) substrates. The film synthesis was performed in two steps. The Ba-Ca-Cu precursors were deposited from an aerosol of Ba, Ca, Cu acetylacetonates onto Ag texturized tape, followed then by thallination in a two- zone furnace. Two types of substrate were used, Goodfellow commercial Ag-foil (99.9 % purity) and a foil with preferred grain orientation produced by us by using hot rolling of Ag-bulk, with the total rate of reduction being about 95 %. During the Tl-diffusion the precursor film has been kept at 850 ºC with the Tl-source being kept at 750 ºC. Thallination has been performed in an O_2-flow. So far, the prepared samples were characterized by x-ray diffraction and EDAX and SEM observations. These results show plate-like grains of Tl-1223 phase on the sample surface with rather strong c-axis orientation perpendicular to the substrate surface. The characterization of the electrical properties of synthesized films is currently on the way. Influence of various substrates upon properties of films is also discussed.

MS.6

MgB_2 Superconducting Thin Films on R-Sapphire and Si(100) Substrates Prepared by E-Beam Sequential Evaporation and *In-Situ* Annealing Process

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Superconducting thin films have been prepared on saphire and Si substrates using sequential e-beam evaporation of boron and magnesium. The deposition at room temperature was divided into 6 steps where boron and magnesium films were alternated up to tickness 300 nm. Background vacuum was 10^{-4} Pa. In-situ annealing was performed at 620 °C for different partial pressures of Ar. The maximum zero resistance critical temperature was 26 K with an onset transition at 34 K.
Films were characterized by X-ray diffraction, energy dispersive x-ray analysis (XRD), the film surface has been investigated by SEM. Raman scattering has been measured as a function of temperature and nuclear reaction method has been employed to investigate the film chemical composition. Results of these characterizations are presented.

MS.7

Apical Oxygen Motion and the Optical Conductivity of the High-T_c Superconductor $PrBa_2Cu_3O_7$

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We present a study on the changes in the electronic structure of the high-Tc superconductor PrBa2Cu3O7 when the apical Oxygens are moved out of the equilibrium position. Using a tight-binding method we analized the three different arrangement and the consequences on the electronic structure and the optical conductivity. We proposed a test to find the predominant arrangement using the optical conductivity.

MS.8

Respuesta Magnética de Superconductores Tipo II Sometidos a un Campo Magnético Paralelo Rotante

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La manifestación del efecto de corte de líneas de flujo magnético en el comportamiento de la respuesta de un superconductor tipo II sometido a un campo *magnético* rotante o experimentando oscilaciones bajas en un campo magnético estático son analizados te6ricamente. Se aplica tanto el modelo del doble estado critico generalizado come el modelo hidrodinámico de dos velocidades para interpretar los resultados experimentales disponibles. Se muestra que conforme la amplitud de oscilación del ángulo de rotaci6n del campe magnético externo aumenta los ciclos de histéresis se abren. Esta apertura de los ciclos de histéresis ha podido ser reproducida solamente por el modelo del doble estado critico. Los limites de aplicaci6n de ambos modelos son discutidos.

Trabajo apoyado parcialmente por CONACyT.

MS.9

Early Stages of the YBCO Growth by PLD on Copper Substrates

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The initial stages of the growth of $YBa_2Cu_3O_{7-\delta}$ (YBCO) thin films by pulsed laser deposition(PLD) were studied. The YBCO films were grown on copper substrates at 650°C. The layers were characterized using SEM, EDS, AFM and Magnetic Susceptibility Measurements(MSM). The SEM and AFM studies demonstrate the initial growth stages process is limited by the island growth mechanism. Chemical composition determined by EDS shown the samples grown with barium excess. The superconductive transition temperature measured by MSM was 37 K, therefore the layers are comprised by several low temperature superconductive phases. During the growth process some copper oxide islands are identified specially at the initial stages.

MS.10

Orbital Angular Moment and Magnetic Anisotropy Energy of *3d* Transition Metal Linear Chains deposited on a Non-Magnetic Step: *Co/Pd(111)*

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Most of the theoretical works about deposited *3d* transition metal structures assume a perfectly flat substrate surface; however, even the best substrates are stepped. In order to investigate the influence of these steps on the magnetic properties of such systems, we calculate the magnetic anisotropy energy (MAE) and the spin and orbital magnetic moments of Co infinite linear chains deposited on Pd (111) steps. To determine the redistribution of the electronic density associated with changes in the local arrangement of atoms we use a self-consistent tight-binding approach taking into account the hopping integrals and the spin-orbit term on the same footing.

MS.11

Estructura Electrónica del USb antiferromagnético: I. Un estudio ESOCS y FP-LAPW

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En este trabajo se hace un cálculo *ab-initio* del compuesto intermetálico USb[1], usando para esto los métodos ESOCS[2] y FP-LAPW[3] dentro de la teoría DFT.
Se obtendrá la geometría óptima, densidad de estados, estructura de bandas, absorción del sistema y se comparán los resultados obtenidos en ambas metodologías. Todo esto se hace como un estudio preliminar a su comportamiento como material fermionico pesado.

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MS.12

Ferromagnetic Coupling of the Mn-Co Surface Ordered Alloy on Co(001)

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Experimental studies of the grown of Mn on Co/Cu(001) fcc substrate shown the alloy formation on the surface with a ferromagnétic coupling between 0.3 and 0.8 monolayers. After these results, we have made an ab initio study of the spin polarization and the stability of the magnetic configurations of the Mn monolayer and Mn-Co surface ordered alloy on Co(001) fcc substrate, with the method Tight-Binding Linear Muffin-Tin Orbitals in Atomic Sphere Approximation (TB-LMTO-ASA). The exchange correlation used in this work is Generalized Gradient Approximation (GGA) of Perdew-Wang-91. The results obtained shown that the configurations of ordered alloy are more stables than the configuration with Mn monolayer on Co(001) and the ground state is ferromagnetic, in very good agreement with the experimental results.

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SESIÓN DE CARTELES II
POSTERS' SESSION II
Jueves 4 de Octubre

PDII: Películas Delgadas I **SEMII:** Semiconductores II **DIEII:** Dieléctricos II
RECII: Recubrimientos II **CMII:** Caracterización de Materiales II **NANO:** Nanoestructuras
CIS: Ciencia e Ingeniería de Superficies **EI:** Electrónica e Instrumentación

PDII.1

Cu Surface and Monolayer-on-Ni States

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We have calculated the local density of states for a Cu surface and monolayer on a Ni substrate on the (001), (110), and (111) orientations. We locate the surface states in each case and compare with the existing experimental and theoretical results. We use the Surface Green's Function Matching (SGFM) method and show that it works very well for this purpose. We further follow the surface states when a small contraction or expansion on the topmost layer is allowed.

PDII.2

Deposition of TiN/AlN Bilayer on a Rotating Substrate Holder from Reactive Sputtering

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Transition metal nitrides, especially TiN, have been traditionally used as protective coatings for cutting tools but more recently the largestT increases in hardness and strength can be achieved with nitride multilayer coatings such as TiN/AlN, VN/TiN, NbN/CrN and NbN/TiN.). One important property of the TiN/AlN coatings is that they comply two important requisites of the protective coatings: the good adhesion properties of the TiN films and the chemical stability of the AlN films.
We have developed a balanced dual-cathode reactive magnetron sputtering deposition system which allows us to grow TiN/AlN bilayers from pure titanium and aluminum targets in a mixture of argon and nitrogen gases. The deposition temperatures were always kept lower than 70^0C. This fact is very important for industrial applications.
The chemical and structural properties of the grown layers have been studied by AES (Auger Electron Spectroscopy), ERDA (Elastic Recoil Detection Analysis) and XRD (X-Ray Diffraction) techniques and the results have been correlated to the main deposition parameters.

PDII.3

Bimetallic Mo/Al Alloys Thin Films

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The synthesis of nanostructured materials was pioneered by the inert gas condensation and compaction technique. We investigate the magnetron sputtering technique as an alternative processing route in comparison with thermal evaporation. We have studied the elaboration process and alloy formation by annealing as a function of molybdenum content.
Mo/Al thin films were prepared by rf magnetron sputtering technique using 100% argon gas at 10 mTorr of working pressure. The Mo layer thickness was varied form 20 to 1800 nm. Films were characterized by X-ray diffraction (XRD), optical microscopy (OM), scanning electron microscopy (SEM), energy dispersive spectroscopy (EDS), atomic force microscopy (AMF), Rutherford backscaterring spectroscopy (RBS) and reaction nuclear analysis (RNA) techniques. Annealing treatments were done from 100ºC to 600ºC under argon atmosphere to produce different nanocrystalline Mo/Al alloys thin films. The influence of alloying thermal process on hardness was analyzed by Vicher's indentation. Results showed that hardness was influenced by the alloying microstructure and interface compositional profile.

PDII.4

Thermoluminescence Response of Aluminum Oxide Thin Films to Beta-Particle and UV Radiation

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Aluminium oxide thin films were grown by laser ablation from an Al_2O_3 crystal disk. The thin films were deposited on pieces of silicon (100) wafers. The structural characterization revealed the growth of an amorphous material. Surface morphology of the obtained thin films show a smooth surface with dispersed splashed particles with diameters ranging from approximately 0.2 μm to 5 μm. The films were exposed to UV (254 nm) and beta-particle radiation (^{90}Sr-^{90}Y). Thermoluminescence glow curves exhibited two peaks centered at 95 and 162 °C for UV irradiation. For beta-particle irradiation the thermoluminescence glow curve shows only the presence of the high temperature peak. The 162 °C peak shows good stability and 10% fading in the first 4 days after irradiation. A linear relationship between absorbed dose and the thermoluminescence response up to 20 Gy was observed for beta-particle irradiation. The thermoluminescence parameters obtained showed a second order kinetics and an activation energy of 1.2 eV for the 162 °C peak. These properties make aluminum oxide thin films potentially attractive as an ultra-thin dosimeter for UV and beta-particle radiation.

PDII.5

Interaction of Two Laser Ablation Plasmas

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The interaction of two plasmas generated by laser ablation (Nd:YAG laser at λ = 1064 nm) from two perpendicular carbon targets was analyzed by optical emission spectroscopy and fast photography, using a gated CCD. The experiments were carried out in high vacuum (8×10^{-6} Torr). Spatial and temporal measurements were performed. The covered spectral range was from 280 nm to 740 nm. It was found that the emission intensity of the excited species significantly decreased, when the plasmas were interacting. The remaining emission corresponds to CII (426.7 nm) and CIII (406.8 nm), with $I_{CII} >> I_{CIII}$. Time of flight measurements showed that the interaction of the plasmas produced more energetic species, with values as high as 10 keV for the CII specie, however, they lived for shorter times. Carbon thin films were deposited at different positions relative to the plasmas and subsequently characterized by scanning electron microscopy and Raman spectroscopy.

PDII.6

Energy Transference in Al_2O_3 Films Doped with Cerium and Manganese Ions

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Cerium and manganese doped Al_2O_3 films were deposited by the Pyrosol technique. Al_2O_3:Mn films do not presents luminescent emissions. On the other hand, blue photoluminescence emissions from Al_2O_3:Ce films is obtained but as some concentration of Mn ions is added red emission appears. This red emission is characteristic of the manganese ions. Presumably this phenomenon is due to an energy transference process. In this work, a detailed study on the energy transference between above cited ions is performed. In addition, the influence, on the luminescent properties, of the preparation parameters is investigated.

PDII.7

Blue, Green and Red Luminescent Emissions from Al_2O_3 Films Doped with Earth Rare Ions

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Cerium, terbium and europium doped Al_2O_3 photoluminescent and cathodoluminescent layers have been prepared by ultrasonic spray pyrolysis deposition technique. Different substrate temperatures and doping concentrations of solution in the start spraying solution were studied. It is observed that the crystalline structure of the films is non-crystalline at substrates temperatures from 300 – 600 °C. Photoluminescence excitation and emission spectra were obtained as a function of the preparation parameters. Concentration quenching of the luminescence occurs at determinate activator concentration. Cathodoluminescence spectra as a function of the electron accelerating voltage, substrate temperature and activator concentration were obtained.

PDII.8

Caracterización de Películas Delgadas DE CdS:In^{3+} Crecidas por DBQ

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Por el método de Baño Químico se crecieron películas delgadas de CdS:In^{3+}, a partir de las condiciones de crecimiento se introducieron diferentes concentraciones de In^{3+}. Dichas muestras se caracterizaron por Absorción Óptica, Rayos X, Conductividad en el Obscuro y Termopotencia. Por las diversas técnicas de caracterización se notaron los cambios en las propiedades ópticas y eléctricas como consecuencia de dicha impurificación, sobre todo en el aumento de la densidad de portadores activos, al ser calculado esto último por termopotencia.

PDII.9

Caracterización de Películas Delgadas de CdS Impurificadas con In^{3+} y Recocidas en Ar+In

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Películas delgadas de CdS:In^{3+} crecidas por Baño Químico y recocidas en atmósfera de Ar+In han sido caracterizadas por absorción óptica y Rayos X. Aplicando la primera técnica se determina el valor de E_g notándose una disminución de éste cuando cuando la temperatura de recocido aumentó. Por rayos X se determinó la distancia interplanar en la dirección [111], observándose un aumento en tal distancia interplanar como consecuencia del recocido. Los resultados de este trabajo resultan diferentes a los obtenidos en muestras sin tratamiento térmico.

PDII.10

Deposition of GaN_xAs_{1-x} Thin Films by Radio Frequency Magnetron Sputtering

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GaN based semiconductors are of great interest for the applications to optical devices in the wavelength range from green to ultraviolet. In the GaN rich-side of the GaN_xAs_{1-x} ternary compound it is expected that the band gap energy could be adjusted for all the visible spectra by changing the N concentration in the compound. GaN_xAs_{1-x} thin films were deposited on Corning glass, sapphire and GaAs substrates by radio frequency magnetron sputtering at room temperature. A GaAs single crystal was used as the sputtering target. Nitrogen incorporation was accomplished by mixing a high purity N_2 gas with Ar into the growth chamber in order to produce a plasma rich in nitrogen ions, which could incorporate in the film. We were able to grow GaN_xAs_{1-x} films with different stoichiometries which showed different values of band gap energy in the range from 1.6 to 2.3eV as established from the absorption spectra measured to room temperature. We discuss the possible mechanisms-taking place during the growth process, which influence the nitrogen incorporation in the films changing their bandgap energy, as well as the influence of different substrates in the crystalline quality of the thin films.

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PDII.11

Structural and Morphological Properties of Alumina Thin Films Synthesized by Ultrasonic Pyrosol Process from $Al(ACAC)_3$

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Microscopic characteristics of aluminum oxide thin films deposited on silicon substrates are reported. The films were deposited using the spray pyrolysis technique from a spraying solution of aluminum acetylacetonate ($Al(acac)_3$), dissolved in N,N-dimethylformamide (N,N-DMF), at temperatures in the range from 500 to 650º C. The addition of water mist during the deposition process led to a remarkable improvement of the overall characteristics of the films. Transmission electron microscopy showed that the films were obtained with the presence of a tiny $5Al_2O_3{:}H_2O$ crystalline phase embedded in a dense amorphous matrix. It was found that the volumetric fraction of this phase depended on the temperature during deposition and on the molarity of the solution used. The surface roughness of the films, obtained by Atomic Force Microscopy (AFM), resulted extremely low and from Wavelength Dispersive Spectroscopy (WDX) measurements, the films resulted stoichiometric, when deposited with the addition of water. Deposition rates up to 540 Å/min with low chemical etch rates and activation energies around 28 kJ/mol were also determined. It is observed that the electrical conduction mechanism of the films is extremely depended on existence of the $5Al_2O_3{:}H_2O$ phase embedded in a dense amorphous matrix, probably to H_2O related traps. In addition, morphological properties of the surfaces of the films, obtained by SEM, are presented.

PDII.12

Some Physical Properties of $AglnS_2$ Thin Films Prepared by Spray Pyrolysis Technique

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Considerable attention has been devoted to the preparation and study of the physical properties of chalcopyrite compounds belonging to the l-lll-Vl_2 group owing to their importance in the development of solar cells and to non- linear optics. These materials are ternary isoelectronic analogs of the Il-VI binary compounds, which is closely related to that of zincblend. AglnS2 is a wide band- gap semiconductor, unique among the l-lll-Vl_2 compounds in that it exists in two ordered phases: chalcopyrite and orthorhombic.
In this work we present our findings on the characterization of $AglnS_2$ polycrystalline thin films prepared by chemical spray pyrolisis technique. We have prepared $AglnS_2$ with chalcopyrite and orthorhombic structure by varying the indium to copper ratio in spray solution. These films exhibit an n-type conductivity, room temperature resistivities in the 10^3 -- 10^4 Ω-cm range, and an absorption coefficient of the order of 104 cm'' for photon energies near the fundamental edge. The absorbance derivative spectra of chalcopyrite $AglnS_2$ reveal two energy gaps of 1.88 eV and 2.03 eV, which are in good agreement with the observed energy values for the transitions between the splited valence band and the conduction band in single crystals of chalcopyrite $AglnS_2$. The low temperature photoluminescence (PL) spectra of chalcopyrite and orthorhombic films display deep PL peaks which might be associated to electron-hole recombination between deep donor and deep acceptor defects.

PDII.13

Chemical Bath Deposition of ZnS-ZnO Thin Films and their Optical and Structural Properties

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The optical and electrical properties of the chalcogenide metals thin films depends strongly on the synthesis method of this kind of materials and on the synthesis conditions. Chalcogenide metals thin films exhibit promising optical and electrical properties to be potentially useful in the fabrication of a diversity of optoelectronic devices. From that, an great interest has arised for the development of new sistematic, simple and cheap methods for the synthesis of calcogenide metals thin films. With the development of these methods is hoped to get materials with new o improved properties that commercially available materials exhibit.
In this work, the development of a new chemical bath deposition method for the synthesis of ZnO-ZnS thin films is presented, together with the optical and electrical characterization of these materials. The reaction is controlled by using metallic complex with adequate stabilities, which reacts with an adequate source of sulfide ions. The films exhibit an emission peak around 425 nm. The scanning electron microscopy images show needle shape crystals on the surface of some films.

PDII.14

Mecanismos de Relajación de Energía Elástica en Heteroestructuras Inhomogéneas en las Costantes Elásticas

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Calculamos el campo elástico de una heteroestructura debido a un sistema periódico de dislocaciones de desajuste. Demostramos que la funcional de la energía y la distribución de los campos elásticos dependen de la relación entre las constantes elásticas de la película y el substrato, así como también de la distancia de las dislocaciones de desajuste a la interfaz. Mostramos que la relajación de la energía elástica ocurre por dos mecanismos. El primero predice la existencia de dislocaciones independientemente del espesor de la película. El segundo predice que las dislocaciones aparecen cuando el espesor excede un valor crítico.

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PDII.15

Investigation of the Decomposition Processes of *InGaAsP* Solid Solution Grown on InP Substrates

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It is known *that* among the different III-V multicomponent solid solutions, a wide miscibility gaps exist in the some systems. Theoretically in has been shown that a miscibility gap can exist in the *InGaAsP* solid solutions, which are widely used to produce different semiconductor devices. In this work it was experimentally investigated the decomposition processes of *InGaAsP* solid solution. For that purpose the change in the photoluminescence spectra of *InGaAsP*,*P*, epitaxial layers of various compositions grown on *InP* substrates after thermal treatments have been studied. To prevent the epitaxial layers from degradation, due to phosphor evaporation during the baking, their surface was covered by spin-on SiO_2 layers. The photoluminescence *spectr*a showed no changes for solid solutions near *InP* and I*nGaAs*. For compositions in the middle of the lattice-matched area the variations were very noticeable because the appearance of an additional peak in the luminiscence spectra. This could be related to the decomposition of those solid solutions whose compositions lie inside a theoretically predicted miscibility *gap*.

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SEMII.1

Effect of Hydrogen Dilution on Electrical Properties of a-Si:H Films Prepared by Low Frequency PECVD

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This work is addressed to the effect of hydrogen incorporation on the electrical properties of amorphous silicon films (a-Si:H), prepared by Low Frequency Plasma Enhanced CVD. Undoped a-Si:H films were deposited in LF PECVD system using silane (SiH_4) and hydrogen (H_2) mixture at discharge frequency f=10 and 110 kHz. Hydrogen dilution characterized by flow rate ratio R= Q_{H2}/ Q_{SiH4} was changed in the range of 0 to 40. Current – Voltage (I-V) characteristics were studied and temperature measurements of conductivity in dark (σ_d) and illuminated (σ_p) conditions were performed in DC regime. In the range R=0… 40 σ_d changes by 2 orders, from $3.6x10^{-7}$ to $3.45x10^{-9}$ $(\Omega\text{-cm})^{-1}$. Activation energy (Ea) changes from 0.82 to 0.41 eV. σ_p was measured under AM1 conditions. The σ_p changes from 2.47 $x10^{-6}$ to $4.11x10^{-5}$ $(\Omega\text{-cm})^{-1}$. We observed correlation between σ_d(R), optical properties and hydrogen concentration and bonding in the films deposited with varied hydrogen dilution. The highest value of σ_p/σ_d ratio was achieved in the samples deposited at higher discharge frequency f=110 kHz and the highest hydrogen dilution R = 40. These samples had minimal concentration hydrogen.

SEMII.2

Fabricación y Caracterización de Micro-Espejos en Silicio Monocristalino

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Se describe el proceso de fabricación de micro espejos y/o micro lentes mediante el método de grabado anisotropico de silicio (grabado húmedo), mediante una solución diluida de KOH al 44 % .
En este trabajo se utilizan obleas de silicio con orientación (100), en las cuales se crece una película de oxido de silicio (SiO_2), después mediante litografía se definen ventanas (cuadros pequeños) y el grabado final se realiza en dos etapas con la solución de KOH a una temperatura de 60°C. Con este procedimiento se obtienen depresiones esféricas; las cuales se podrán utilizar como interconectores ópticos y en computación óptica, además de otras posibles aplicaciones ópticas, se muestran resultados experimentales.

SEMII.3

Growth of Thick Epitaxial InAs Layers by CSVT

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InAs epitaxial layers have been grow by Close Spaced Vapor Transport using water vapor as transporting gas. Growth rates can be controlled trough source and substrate temperatures as well as by the transporting gas partial pressure. Epitaxial growth mechanism and layers physical properties have been studied. Growth rates as high as 1 ìm/min are currently obtained. Layers have been studied by double X ray diffraction, 1.7 K infrared absorption and photoluminescence, and Secondary Ion Mass Spectroscopy. Results will be presented and discussed as well as first results on the growth of layers as thick as 130 ìm.

SEMII.4

MO-CVD GaInP HBT Current Gain Stability Under Current Stress

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The evolution the GaInP/GaAs heterojuntion bipolar transistor current gain under current stress, so called "burn-in" process, is studied through the different transistor currents. The active layers in the transistor were grown by metalorganic chemical deposition and the base is carbon doped. We have found that during the burn-in process all the currents decrease as a function of the stressing time. Simultaneously, it is observed a current gain increase produced by a more important reduction on the hole current injected into the emitter. Such current reductions can be explained as a result of room temperature dopant reactivation at both sides of the emitter base junction. A detailed burn-in model will be presented and discussed.

SEMII.5

Carbon Acceptor Doping Efficiency in MOCVD-GaAs

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Carbon doping efficiency in GaAs grown by metalorganic chemical vapour deposition using intrinsic and extrinsic doping sources is studied. It has been found that independent of the carbon source, carbon hydrogen complexes are systematically present and depending on the growth conditions, carbon dimers can be present and form complexes with hydrogen as well. Carbon-hydrogen related complexes and dimers reduce the hole concentration decreasing the doping efficiency in a one to one ratio. Hydrogen binding energy to the carbon dimer is higher than to the isolated carbon acceptor confirming the presence of a deep energy level due to the carbon dimer. Additionally, the carbon dimer deep level introduces decreases the hole mobility and thus device performance. Our measurements show that depending on the growth conditions it is possible to reach 100% doping efficiency with high hole mobility. On the contrary if carbon doped layers containing C_2-H complexes are used in electronics devices hydrogen can debond during device operation endangering device performance

SEMII.6

RETIRADOCarbon Switching in MOCVD Carbon Doped GaAs***WITHDRAWN***

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Carbon doped GaAs MOCVD epitaxial layers might contain C_{As}-Ga-C_{As} dimmers. In such a case doping efficiency is lowered and caarriers transport properties deteriorated. It has been observed that prolongated rapid thermal annealing treatments can lead to an anomalous hole concentration increase. In this work we will present experimental results showing such behaviour as well as a model that explain it through a carbon switching mechanism.

SEMII.7

On Metastabile Properties of Plasma Treated a-Si:H Thin Films

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Amorphous hydrogenated silicon (a-Si:H) is well known as a semiconductor with metastable properties. This paper deals with optical, structural and electrical properties of virgin and ion beam exposed a-Si:H surfaces. A considerable part of the contribution illustrates the influence of both oxygen and argon plasmas on the luminescent properties of a-Si:H. The new results obtained by several experimental techniques are presented, photoluminescence at 6 K and X-ray diffraction at grazing incidence being the most important.
We also report on the changes induced in the gap-state distribution due to the interaction of the virgin a-Si:H surface with low-energy Ar ions followed by a short surface exposure to hydrogen and oxygen ion beam mixture. This type of experiments leads to the formation of a new ultrathin dielectric overlayer covering the etched semiconductor surface which is thicker in comparison with the native dielectrics formed after PCVD of amorphous layer. The new insulating layer with an increased resistance against the electrical breakdown can be prepared in this way and therefore it seems to be a promising technique in the future.

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SEMII.8

Fabricación y Caracterización de Inductores sobre Silicio

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El presente trabajo describe la fabricación de inductores pasivos sobre substratos de silicio, así como su caracterización en el rango de 400 MHz a 5 GHz.
Los inductores pasivos integrados presentan una mejor respuesta en altas frecuencia que los inductores activos (diseñados con transistores). Estos son fabricados en la superficie del semiconductor con dos niveles de metal en forma de espiras. Su utilización es principalmente en circuitos de radio frecuencia(RF), y en particular, en aplicaciones inalámbricas. Para este trabajo, la fabricación se desarrolló con una tecnología MOS de 10 micras, con dos capas de aluminio usando SiO_2 como dieléctrico. Los inductores que se reportan son de espiras cuadradas, hexagonales, octagonales, decagonales, dodecagonales y circulares, de 4.5 y 7.5 vueltas.
Un modelado correcto considera los componentes parásitos y sus efectos; el modelo utilizado considera una inductancia en serie con una resistencia, un capacitor entre el puerto de entrada y el de salida, y en cada puerto se tiene un capacitor en serie con una resistencia aterrizada. Para facilitar el análisis se considera al modelo como una red de dos puertos de parámetros agrupados. Los valores de los componentes se extraen por optimización

SEMII.9

Electron and Phonon Thermal Waves in Semiconductors: The Effect of Carrier Diffusion and Recombination on the Photoacoustic Signal

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The electron and phonon temperature distributions are calculated in bipolar semiconductors taking into account generation and heating of carriers on the surface due to an incident modulated laser beam on the surface and finite carrier diffusion and recombination in the solid. We solved the coupled one-dimensional heat and carrier- diffusion equations in the linear approximation using appropriate boundary conditions according to the photoacoustic experimental conditions. In addition, special emphasis is pointed out in the electron system heat flux dependence of the electron and phonon temperature. We also consider the recombination of the electron-hole pair is influenced by both temperatures. The dependence of the amplitude and phase of the electron and phonon temperatures on the modulation frequency are analyzed for different values of characteristic parameters of the problem: electron-phonon energy exchange and carrier thermal generation rate. In order to do it remarkable we neglected the heating of carriers on the surface.

SEMII.10

Raman Scattering Determination of Free Carrier Concentration in Te Doped GaInAsSb Alloys Grown by Liquid Phase Epitaxy *

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Raman scattering has been used to study Te-doped $Ga_{1-x}In_xAs_ySb_{1-y}$ alloys grown by liquid phase epitaxy in a doping level from 10^{16} to 10^{19} cm^{-3}. The relative intensity between the undoped and doped samples served to estimate this doping level of Te and the results agree with the theory. We also estimated the depletion layer depth as a function of the carrier concentration. This method demonstrate the ability to use Raman scattering to explore the structural and transport properties of this kind of quaternary alloy.

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SEMII.11

Dispersión Raman, XTEM y AFM de Películas Epitaxiales de GaAs Crecidas en Ambiente de Hidrógeno Atómico*

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Se creció una serie de películas homoepitaxiales de GaAs empleando la técnica de transporte de vapor a corta distancia (CSVT) con hidrógeno atómico. Para el crecimiento de las películas se emplearon fuentes de GaAs tipo-p y sin impurificar. Los espectros de mediciones Raman de películas crecidas a partir de fuentes sin impurificar, indican que se cumplen la regla de selección para monocristales. Los espectros de dispersión Raman de las películas crecidas a partir de fuentes impurificadas con Ge, muestran la presencia del fonón óptico con frecuencia de 304 cm^{-1} que corresponde al fonón óptico longitudinal del germanio. La presencia del fonón óptico del germanio es el resultado del transporte químico de la impureza aceptora por el hidrógeno atómico. Los espectros Raman de las películas crecidas con impurificación muestran una pequeña señal de frecuencias fonónicas que corresponden al fonón óptico transversal que se ha relacionado a la rugosidad que presentan estas películas semi-especulares. Mediante patrones de difracción por microscopía electrónica de transmisión (XTEM) se ha encontrado cristalinidad en la película crecida, sin embargo en algunas regiones donde es más evidente la apariencia semi-especular se presenta una estructura tipo mosaico. Se presentan además imágenes de la morfología superficial obtenidas por microscopía de fuerza atómica (AFM) y se relaciona la frecuencia fonónica TO con la rugosidad de la película epitaxial.

*:Trabajo realizado con financiamiento del CONACyT proyecto J28353A y por el fondo solidario Fortuna.

SEMII.12

Growth and Characterization of CdTe/ZnTe Ultra-Thin Quantum Wells Obtained by Pulsed Beam Epitaxy*

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Ultra-thin quantum wells (UTQWs) of CdTe with ZnTe barriers were successfully grown by pulsed beam epitaxy [also known as atomic layer epitaxy (ALE) or migration enhanced epitaxy (MEE)] on GaAs(001) substrates. The growth of CdTe was performed by alternate exposure of the substrate surface to individual fluxes of Cd and Te. Under our growth conditions we have a ~0.5 monolayer (ML) coverage per cycle. Two different samples with 2 ML (4 cycles) and 4 ML (8 cycles) CdTe UTQWs were grown. *In-situ* reflection high energy electron diffraction (RHEED) patterns and real-time spot intensity measurements indicated a high structural quality of the QWs. Low temperature photoluminescence (PL) experiments were performed at 15 K by using a 4880 Ar^{+} laser line. The PL spectra exhibited intense and sharp peaks associated to the CdTe QWs: a single peak at 2.26 eV of 11 meV full width at half maximum (FWHM) for the 2-ML thick UTQW and, 2.13 eV and 30 meV FWHM for the 4-ML thick UTQW, this red shift is mainly due to the difference in the well dimensions, although strain, and Cd diffusion and re-evaporation need to be taken into account. Quite weak signals from the ZnTe barriers were observed in both cases. The weakness of the ZnTe signal is attributed to a high diffusion length of the photogenerated carriers from the barriers to the wells, an indication of the high crystalline quality of our samples. PL vs temperature measurements show that these sharp peaks broaden and shift to lower energies as temperature rises, and they vanish at ~120 K. Room temperature (RT) photoreflectance (PR) spectra showed contributions both from the wells and the barriers, as expected. Our results demonstrate that CdTe, an infrared band gap semiconductor (Eg = 1.5 eV at RT), is a good candidate for application in the IR to green spectral range of novel optoelectronic devices.

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SEMII.13

Characterization of ZrO_2:Mn,Cl Luminescent Coatings Synthesized by the Pyrosol Technique

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Manganese doped zirconia luminescent films have been deposited at temperatures ranging from 250 °C to 500 °C using the Pyrosol technique. The material obtained is in an amorphous state up 400 °C. For higher temperatures a polycrystalline material is obtained with a cubic and/or tetragonal crystalline zirconia phase. The photoluminescence and cathodoluminescence spectra show the bands associated with the electronic transitions $^{4T1}(^{4}G) \rightarrow {}^{6}A_1(^{6}S)$ of the Mn^{2+} ions. A decrease of the luminescence, as a function of the doping concentration, substrate temperature and electron accelerating voltage is observed. The presence of chlorine seems necessary for the red photoluminescence. The surface morphology of the films is also presented.

SEMII.14

Kinetics of Growth of $Zn_{0.5}Cd_{0.5}Se$ (100) Ordered Alloys *

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The investigation of II-VI based heterostructures for application in light emitting devices in the blue-green range of the visible spectrum has generated important activity in the last few years. The heterostructures are typically grown on GaAs substrates and involve the growth of quantums wells of $Zn_{1-x}Cd_xSe$ ternary alloys.
The $Zn_{0.5}Cd_{0.5}Se$ alloy can be grown by molecular beam epitaxy (MBE), the substrate is simultaneously exposed to Zn, Cd and Se fluxes from the effusion cells. The crystalline array presents randomly distributed Cd and Zn atoms in the cationic fcc sublattice. The ordered alloys can be in principle obtained by alternate cycles of exposure of the surface to of each of the constituent atoms, opening only one effusion cell at a time while the others remain closed, for example, by Zn-Se-Cd-Se growth cycles. This technique has been called migration enhanced epitaxy (MEE) or atomic layer epitaxy (ALE). The actual composition of the cation layers will strongly depend on the surface reconstruction, on the duration of the Cd and Zn pulses, and, on cation interdiffusion. It is accepted that the cation surface presents a c(2x2) reconstruction with only half of the full monolayer coverage. Then, alternate Zn-Se-Cd-Se cycles would prevent the growth of fully ordered layers and a film with a higher degree of order could be obtained by Zn-Se-Zn-Se-Cd-Se-Cd-Se growth cycles.
In this work we present the results of the kinetics of growth of $Zn_{0.5}Cd_{0.5}Se$(100) alloys produced by MBE and ALE. The characterization was done by real time analysis of *in-situ* reflection high energy electron diffraction (RHEED) patterns. The analysis during growth of the temporal behavior of the intensities of different spots in the diffraction pattern gives information about the kinetics and growth modes of the ZnSe, CdSe and $Zn_{0.5}Cd_{0.5}Se$ films. After the analysis of the ALE cycles during ZnSe and CdSe growth in the 260 ºC- 330 ºC temperature range we found that each layer needs several seconds to reach quasi-stationary conditions. With these information we proceeded to the growth of Zn-Se-Zn-Se-Cd-Se-Cd-Se cycles by ALE. The analysis of the RHEED oscillations during the growth at different temperatures of the ordered alloys and of the ZnSe and CdSe films allows the identification of i) re-evaporation of the impinging species, ii) different surface reconstructions for the Cd terminated surface of CdSe, iii) CdSe lattice constant fluctuations for different terminated surfaces, and, iv) growth mode changes.
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SEMII.15

Structural and Technological Considerations in the Design of Quantum Hall Effect Devices

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Nowadays the quantum Hall effect is the basis to obtain the electrical resistance standard mainly due to the fact that it strictly depends only on universal constants as the electron charge and the Plank constant. The resistance standard obtained in this way is unaffected by geometrical characteristics, such as size or shape of the device, etc. However, care should be taken in the design of quantum Hall devices to avoid introducing effects such as noisy characteristics, the need for lower measurement temperatures, and some kind of aging for the metal-semiconductor contacts. These effects have great impact in the performance of the devices. In this work we discuss the design requirements for resistance standard devices based on the quantum Hall effect. We have studied different quantum Hall devices, and finally a structure is proposed.

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SEMII.16

Electrical Characterization of High Electron Mobility Systems Based on AlGaAs/GaAs Heterostructures Grown by MBE

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Currently, high electron mobility structures are widely applied in communication systems, such as high electron mobility transistors, and in metrology in quantum Hall effect devices for resistance standards. III-V semiconductors are mainly used for such kind of structures, the most important systems from the technological point of view are those based on the AlGaAs/GaAs heterojunction. The present work is focused in such systems. A set of samples changing structural parameters such as the buffer layer thickness, spacer layer width, etc., were grown by molecular beam epitaxy. We performed an electrical characterization of the samples and studied the variations in parameters such as the electron mobility produced by the changes in the structure of the samples. Other structure-induced effects are also discussed.

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SEMII.17

Characterization of GaPN Layers Grown by Molecular Beam Epitaxy on Si Substrates

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The heteroepitaxial growth of III-V-N alloys with high crystal quality on Si substrates could make possible the monolithic integration of III-V-N based light-emitting devices with the Si based microelectronics. However the III-V-N/Si heteroepitaxy present serious problems like the lattice mismatch and the difference in thermal expansion coefficients. In order to solve these problems, we have been studying the growth of GaPN with a N concentration of 2% that is lattice-matched to the Si substrate. The epilayers were grown by molecular beam epitaxy employing an RF plasma source to produce active nitrogen species. First, a 3.2µm Si homoepitaxial layer was grown on the substrate, followed by a thin (20nm) GaP layer to avoid the strong interaction of nitrogen with Silicon. Then, the $GaP_{0.98}N_{0.02}$ layer was grown with a thickness of 400nm. In order to avoid the generation of crystal defects induced by the different thermal expansion coefficients the epilayer was capped first with a 16nm thick GaP layer and finally with a 300nm thick Si layer. The structural and optical properties of this sample were compared with those of uncapped GaPN layers grown over GaP/Si and GaP/GaP heterostructures. The photoluminescence at 10K associated to GaP was blue shifted in the capped structure confirming that the GaP layers were coherently strained to the Si lattice. Raman spectra showed GaP and GaN related modes plus an additional mode related to N-induced disorder in
the GaP lattice.

SEMII.18

Study of Chemically-Bath-Deposited CdS Thin Films Doped with Methylene Blue

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The optical and electrical properties of CdS thin films grown on glass substrates by chemical bath deposition were studied. The films were doped with methylene blue (MB) during growth process, by adding specific concentrations of MB into the chemical bath. Pothoacoustic absorption spectra show an evolution of the CdS band-gap energy (Eg) indicating the incorporation of MB into the CdS lattice. Starting from an Eg of 2.42 eV fro the as grown samples, to a band-gap energy of approximately 2.49 reached for the sample doped with 8% of MB. For higher concentrations, no variations are observed, showing a saturation effect.

SEMII.19

Photo- and Cathodo-Luminescence Characteristics of SiO_2 and SRO Films Implanted with Si

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In this work Photo- and Cathodo–Luminescence (PL and CL) of silicon rich oxide (SRO) obtained by PECVD and LPCVD techniques and implanted with silicon (SISRO-PECVD and SISRO-LPCVD) are presented. The PL and CL spectra of SRO-PECVD, SISRO-PECVD and SISRO-LPCVD films are compared with previous results obtained in Silicon Implanted Thermal Oxide (SITO) films. PL and CL spectra of CVD films show similar PL and CL bands than SITO films. The behavior is related with Si-excess of the films. PL results show a higher emission from SISRO LPCVD than SRO-PECVD, SISRO-PECVD and SITO films. The results show that an optimum annealing time exists to get the highest PL intensity. PL from LPCVD films has different behavior than PECVD films, PL from LPCVD films behavior is similar to SITO films but with higher amplitude. We found PL bands at 1.7, 1.9, 2.4 and 2.7 eV, and CL bands at 1.7 and 2.7 eV. The origin of the 1.7 and 2.7 eV are associated to quantum confinement effects mixed with defect interactions. The other bands have their origin in defects due to the Si implantation or defects due to the off-stoichiometry of the material.

SEMII.20

Transition From CdS to $CdCO_3$ by Temperature Deposition Influence

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Thin films were prepared on glass sustrates with the Chemical Bath Deposition technique and using the following molar concentrations: $CdCl_2$ 0.02M, KOH 0.5M, NH_4NO_3 1.5M, $SC(NH_2)_2$ 0.2M. In this work was investigated the temperature influence in the range 80-23 °C while the mechanical agitation, pH, chemical reactives concentrations and volume proportions were fixed. The samples were characterized by Scanning Electron Microscopy, Atomic Force Microscopy, UV-VIS Optical Absoption and X Rays. The SEM results showed that the Carbon and Oxigen were incorporated while the reaction temperature diminished becoming the material in $CdCO_3$ at 23 °C. The sample grown at 23 °C showed a zincblende crystal structure and using the UV-VIS spectroscopy the E_g value was ~3.8 eV, the sample grown at 80 °C has a E_g value of 2.45 eV. The X Rays Diffraction spectra showed the evolution from CdS to $CdCO_3$ when the reaction temperature decreaces.

SEMII.21

Effect of Hydrogen Dilution during Low Frequency Plasma Deposition on Optical properties of SiH_x Films

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Amorphous and micro-crystalline silicon films and related materials are widely used in electronics and commonly deposited by RF (at 13,5 MHz) plasma. Recently VHF discharge at higher frequencies in the range of 50-100 MHz has attracted much attention because of higher deposition rate. However increasing plasma frequency makes more difficult uniform deposition on large area substrates. Meanwhile device quality silicon films have been deposited in low frequency (f=55 kHz) plasma However this type of discharge has not been well studied and therefore only little is known about electronic characteristics of the films and their relationship to deposition conditions. In this work we report on the hydrogen dilution effect on optical properties of amorphous silicon films (SiH_x) deposited in low frequency (55 kHz and 110 kHz) The SIHx films were grown in silane plasma diluted by hydrogen Hydrogen to silane flow ratio R was varied from R=0 to R=40 . We observed that optical properties in visible (spectral dependence of absorption coefficient, optical band gap, refraction index) depended significantly on hydrogen dilution, e.g. optical gap changed from 1.85 to 1.92 eV. Hydrogen bonding and concentration were studied by IR spectroscopy. In the range of stretching modes the lines at 2000, 2060-2090 1/cm were observed. Taking into account deformation modes observed and behavior of all modes with R, line 2060-2090 is supposed to result from contribution of two factors: contribution of Si-H2 (not changed with R) and Si-H bonds attributed to hydrogen bonding on micro-crystalline boundaries (this part was strongly changed with R). Correlation behavior of optical properties and conductivity with hydrogen dilution has been observed.

SEMII.22

Conception of Surface Heat Capacity and its Role in the Nonstationary Heat Problems

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It is well known that boundary conditions in the static heat diffusion problems, which takes into account heat exchange with surrounding at the plane x=0 have the Newton form:

$$c\,\frac{\partial T(x,t)}{\partial x}\Big|_{x=0} = \eta[T_0 - T(x,t)]\Big|_{x=0}, \qquad (1)$$

where $T(x,t)$ is nonequilibrium temperature, T_0 is equilibrium temperature of surrounding, χ is the bulk thermal conductivity, η is the surface thermal conductivity.

This boundary condition usually automatically carry to nonstationary problems of heat transfer, and particularly to the problem of thermal wave propagation.

From our point of view the surface must be characterized by the one more parameter having the sense of surface heat capacity. Physically this follows from conception about different physical and chemical properties surface and volume. Formally this parameter arises from the analysis of the heat diffusion equation at the boundary of two mediums. From this analysis one need to write boundary conditions as follows:

$$c\,\frac{\partial T(x,t)}{\partial x}\Big|_{x=0} + \eta[T_0 - T(x,t)]\Big|_{x=0} = C_s\,\frac{\partial T(x,t)}{\partial t}\Big|_{x=0}, \qquad (2)$$

where C_S is the surface heat capacity.

The presence of the surface capacity results to the energy accumulation at the surface. It is shown that there is some region of the thermal wave frequencies when accumulated energy fully relaxes from the surface to the surrounding. Under another frequency region this energy flows completely into the sample volume. The accumulation of energy essentially influences on the thermal wave propagation and brings the additional phase shift at the detected photothermal signal.

We obtain all frequencies of the problem determining the thermal diffusion process and the mentioned frequency regions. Temperature distributions with boundary condition (2) are calculated, and the special cases are examined. It is shown the possibility of the experimental measurements of the surface heat capacity from the phase shift analysis.

SEMII.23

Cluster or Single Atom Incorporation in Thin Films of MBE-Grown Silicon

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Ultrathin layer systems like multi-quantum-wells and superlattices are of growing interest for both basic research and microelectronic applications. These structures however are thermodynamically metastable, and much care must be taken in their preparation, for which kinetically controlled methods like MBE are ideally suited [1]. A full exploitation of their capabilities requires insight into the microscopic picture of growth which might be influenced by the presence of clusters. Cluster-like surfaces of semiconductors display a chemical reactivity to ambients which is increased by several orders of magnitude.

The participation of small clusters in the growth of perfect crystalline thin films by molecular beam epitaxy is now a generally accepted phenomenon in spite of the atomic nature of incorporation into a one-layer-at-a-time two-dimensional growth process. There is no clear reason, that a cluster, formed of more than three atoms, adopts a two-dimensional appearance (although planar structures of e.g. carbon clusters are known). Such a crude picture already suggests that clusters do not incorporate in a crystal surface without changes of their atomic aggregation and inner bonding. Nevertheless the question, whether a cluster adopts itself to the plane growing surface, maintaining more or less the original neighborhood of atoms, or it decays completely into single atoms, which then acquire mobility and independence from each other, is still unanswered.

We propose a procedure and an experimental technique, which can contribute to resolving this deficiency. Indeed is the knowledge of these processes important for the controlled deposition at high growth rates of perfect crystalline thin films. It may also shed light on the topic of the existence and efficiency of a near surface transition layer in front of a growing film, where the mobility of incorporated species should be high.

The most promising way of 'marking' the atoms in a cluster, might be the use of isotopes, which do not interfere with the physics and chemistry of crystal formation. Nuclear magnetic resonance (NMR) is a classic tool for detection of nuclear paramagnetism, which is related to a nuclear spin present in a number of atoms.

We discuss the application of ^{28}Si- and ^{29}Si-isotopes in clusters, where a difference of NMR-signals occurs in the cases, that ^{29}Si-atoms are surrounded by (unmagnetic) ^{28}Si-atoms, or otherwise for ^{29}Si-atoms surrounded by the same species in the growing films.

[1] A. Zehe: "*Microelectrónica"*, ISBN 969-863-312-7, ed. BUAP Puebla, México 1999.

SEMII.24

Obtención y Caracterización de $TiSi_2$

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En el departamento de Electrónica del INAOE se desarrolla un proyecto que tiene como fin la reducción de 10 a 3 µm en las dimensiones mínimas. Esto implica la reducción en las profundidades de unión, ancho de líneas de interconexión y capas aislantes. No obstante, esto trae varias consecuencias, entre ellas el riesgo de cortos por spiking en contactos a difusiones poco profundas, así como electromigración en líneas de interconexión por el bajo punto de fusión del aluminio. Por lo tanto, se tuvo la necesidad de buscar un material para ser usado como nivel adicional de metalización. Por su baja resistividad (~ 20 µΩ-cm), estabilidad térmica y en ambientes oxidantes se escogió el disilisuro de titanio como material de interconexión y de contacto para reducir el riesgo por spiking. En este trabajo se presenta un método de formación, este consiste en el depósito de polisilicio por LPCVD en uniones poco profundas para evitar el consumo de la difusión. Posteriormente se deposita una capa de titanio y se hace el tratamiento térmico de silicidación a 900°C en ambiente de N_2. De igual modo, se presentan las características eléctricas (tales como resistencia de capa, resistividad, resistencia de contacto, etc.) y estructurales obtenidas en el Laboratorio de Microelectrónica del INAOE en contactos a difusiones poco profundas.

SEMII.25

Space Group and Compatibility Relations of Ordered and Disordered $Zn_{0.5}Cd_{0.5}Se$ Alloys*

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$Zn_{1-x}Cd_xSe$ alloys constitute a very attractive material for optoelectronic applications such as lasers, light emitting diodes (LEDs) and photodetectors. Of particular interest has been the fabrication of quantum well (QW) lasers and LEDs in the blue-green region of the spectrum. The disordered $Zn_{1-x}Cd_xSe$ alloy is described as a anionic fcc sublattice composed by Se atoms and cationic fcc sublattice where the Cd and Zn atoms are randomly distributed with their respective amounts, many of the physical properties of these alloys can be predicted with great accuracy employing the virtual crystal approximation (VCA) assuming that the alloy has the zincblende structure. However, there are some specific compositions, such as x=0.5 in which the cationic lattice may present a spontaneous or induced order, for example, it is possible to alternate the Cd and Zn atoms in the cationic sublattice in such a way that we have a sequence of Se-Cd-Se-Zn… planes along the [001] direction; in this case the VCA approach cannot longer be employed to explain the physical properties of the ordered alloy.

Epitaxial disordered alloys are easily obtained by molecular beam epitaxy (MBE) through the simultaneous exposure of the substrate to Zn, Cd and Se with the appropriate fluxes in order to obtain the desired composition. The ordered alloys can be in principle obtained by alternate cycles of exposure of the surface to of each of the constituent atoms opening only one effusion cell at a time while the others remain closed. Using both methods we have grown thin films and quantum wells of ordered and disordered alloys.

To calculate the electronic and phononic band structure of the ordered alloy the first step is to analyze the expected changes in the physical properties in terms of the symmetry and the double groups corresponding to the space group of this crystal structure ($P\bar{4}m2$ or D_{2d}^5) compared to the zincblende crystal (T_d^2 or $F\bar{4}3m$).

In this work we will present a comparative analysis, from the point of view of the symmetry properties of the crystals, of the differences in the electronic band structure expected between the ordered and disordered alloys. We enumerate the symmetry operations for both alloys and determine their compatibility relations over equivalent points of the Brillouin zone for the extra representations.

*Work partially supported by Conacyt-Mexico.

DIEII.1

ZnO:Al Thin Films Obtained by Chemical Spray: Effect of Substrate Temperature and the Solvent

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Aluminum-doped zinc oxide thin films, ZnO:Al, were deposited on soda-lime glass substrates by the chemical spray technique. The effect of the Al concentration and the type of solvent (methanol, ethanol and isopropanol) in the starting solution, on the resistivity, structure, surface morphology and optical transmittance of the ZnO:Al thin films was studied. The substrate temperature used was of 500º C. The resistivity of the films was in all cases below 0.4 Ωcm. The smallest resistivity values, around 1.3 x 10^{-2} Ωcm, were obtained using a [Al]/[Zn] ratio of 3 at. % in the starting solution and methanol as solvent. All the films were polycrystalline and their surface morphology changed with the type of solvent employed. Films prepared with methanol and isopropanol showed a broad distribution of particle size. On the contrary, films prepared with ethanol showed a uniform particle size, around 110 nm in average. The optical transmittance was higher than 85 % at 550 nm. An increase in the Al concentration produced a shift in the adsorption edge to higher energies.

DIEII.2

Synthesis and Characterization of Aluminum Oxide Thin Films Deposited from Organic and Inorganic Reagents*

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Aluminum oxide thin films have received an increasing amount of interest because of their application as dielectric layers on microelectronic devices as well as hard coatings on different surfaces. Several chemical and physical deposition techniques have been studied to obtain these kinds of films. In this work we present results on aluminum oxide thin films synthesized from organic and inorganic reagents; $Al(acac)_3$, $AlCl_3$ and $Al(NO_3)_3$, using the ultrasonic spray pyrolysis technique. A discussion about their optical, structural, mechanical and electrical properties of the films is reported. The effect produced by nitrogen addition in the physical properties of the films is currently on the way.

* Work supported by CONACyT-Mexico, under grant No. J34225-U

DIEII.3

Photoluminescent Properties of Hafnium Doped ZrO_2 Films Prepared by Ultrasonic Spray Pyrolysis Technique

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Hafnium doped ZrO_2 photoluminescent films have been prepared by ultrasonic spray pyrolysis deposition process. Different substrate temperatures and doping concentrations of solution in the start spraying solution were studied. It is observed that the crystallinity of the films depends on the substrate temperature during deposition of the films. For substrate temperatures lower than 400 °C the deposited films are amorphous, whereas for substrate temperatures higher than 400 °C the crystalline structure of the prepared material presents the metastable tetragonal or cubic phases. In the case of photoluminescence the excitation and emission spectra were obtained. Concentration quenching of the photoluminescence occurs at determinate activator concentration.

DIEII.4

Synthesis and Characterization of ZrO_2:Nd Luminescent Films

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Films of ZrO_2:Nd have been produced from zirconium oxichloride $ZrCl_2O$-H_2O and $NdCl_3$ by Pyrosol process. These films show luminescent properties when they are excited with ultraviolet-light. The luminescence spectrum present typical transitions from the ^4I level belonging to trivalent neodymium. The results of X-ray diffraction show that the ZrO_2:Nd coatings present a metastable tetragonal or cubic phase. Studies on the role of the variations of substrate temperature and activator concentration are presented. In addition, the chemical composition and the surface morphology of the films are also analyzed.

DIEII.5

Study of Some Physical Aspects Involved in the Behavior of the Aluminum/SRO/Silicon Structure

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The off-stoichiometry silicon oxide, or silicon rich oxide (SRO), is a two-phase material formed by silicon dioxide with excess silicon. This material is normaly obtained by Chemical Vapor Deposition (CVD) from silane (SiH_4)and nitrous oxide (N_2O) as the reactive gases. In this method, the gas flow ratio, Ro = $[N_2O]/[SiH_4]$, is used as a parameter that determines the silicon excess. The MIS device, i.e., the Al/SRO/Si structure obtained by deposition of SRO on silicon, and covered with a top electrode, shows a dual behavior depending on the Ro value and the substrate characteristics. It behaves like an MOS capacitor and as a reverse-biased P-N junction, depending upon the appropiate bias. However, until now there is not a model which takes into account the Ro and the silicon substrate to explain the behavior of the SRO/Si junction. In this work, I-V and C-V characteristics curves were obtained for some Al/SRO/Si devices with various Ro values. The depletion widths were obtained from these curves. The widths were modeled by using a P-N deep depletion approximation and it was found that there is a good agreement between the experimental results and the theoretical curves. In the P-N region an effective bulk concentration has to be used. As Ro increases the MOS like structure dominates and the trapped charge is more relevant. As Ro decreases it is possible for the P-N behavior not to be obtained, and the trapped charge in this case does not have an important role. It was also shown that it is possible to use the Al/SRO/Si structure to estimate characteristics constants of the material constituents, as it is the lifetime generation of minority carriers.

DIEII.6

Caracterización de Oxinitruro de Silicio por Espectroscopia de Electrones Auger

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En este trabajo se estudia por espectroscopía de electrones Auger (AES) un conjunto de capas de oxinitruro de silicio crecidas por oxidación térmica con óxido nitroso. Se variaron los parámetros: temperatura T = 1000, 1100, 1200 °C y presión de depósito P = 1, 2, 3, y 4 Atm., obteniéndose un total de 12 muestras. El objetivo es, mediante perfiles de profundidad AES, determinar la distribución en concentración atómica del nitrógeno, así como la localización de mayor acumulación en los sistemas SiO_2/Si. Una comparación de estos resultados con los parámetros de depósito será de gran utilidad para ayudar a elucidar el mecanismo de nitración y la optimización de este proceso de nitración.

DIEII.7

Estudio Morfológico de la Evaporación del BaF_2 sobre Sustratos de Si(111) y su Caracterización por OM, SEM (EDS), y AFM

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Los floruros alcalinotérreos CaF_2 y BaF_2 son considerados como materiales dieléctricos transparentes, y sirven como soporte "buffer" cuando son crecidos epitaxialmente o evaporados sobre sustratos de Si(111), Si(100) y otros semiconductores en la producción de sistemas 3D en la fabricación de circuitos de alta velocidad, de dispositivos optoelectrónicos y sensores. El CaF_2 y BaF_2 presentan la estructura cúbica centrada en la cara (fluorita) y el Silicio (diamante), con constantes de red (Si = 0.543 nm, CaF_2 = 0.546 nm, y BaF_2 = 0.620 nm), de forma que el BaF_2 presenta una marcada diferencia en los coeficientes de expansión térmica a temperatura ambiente (CaF_2/Si(111) = 0.6 %, BaF_2/Si(111) = 21 %). La utilización del BaF_2 evaporado sobre sustratos de Si(111) manifiesta el característico "espesor crítico" de la heterocapa BaF_2-Si(111) que produce dislocaciones y fracturas por los marcados desacoples de red, los cuales son observados por OM, SEM (EDS), y AFM.

RECII.1

Fabricación y Caracterización Óptica de Material Ternario ZnO-CdO-TeO_2

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Este trabajo muestra los resultados de una sección del ternario ZnO-CdO-TeO_2 fuera de la zona de formación de vidrio. Las muestras se prepararon a 1,200° C con alto contenido de ZnO y CdO en crisoles de alta alúmina marca Coor. El material resultante presenta estructura cristalina, aspecto poroso y algunas muestras son extremadamente duras. Mediante difracción de rayos-X, se detectaron las fases cristalinas Cd_3TeO_6, $ZnTO_3$, ZnO y grupos TeO_3. Los espectros de absorción Infrarroja muestran bandas de absorción en el rango de 800-600 cm^{-1}. Los grupos TeO_3 (660 cm^{-1}) son característicos en este material. Estas unidades TeO_3 se presentan con diferentes simetrías, y existen en todo el rango de concentraciones de las diferentes formulaciones. La absorción óptica presenta también una banda intensa en la región ultravioleta, para la muestra con mayor contenido de CdO. Asimismo se observan bandas de absorción correspondientes al ZnO, con mayor intensidad para la muestra con 30% de ZnO. El incremento de ZnO y CdO, produce cambios en las bandas de absorción,correlacionándose con las altas concentraciones de ZnO. Una banda de baja intensidad de absorción se percibe a 462 y 466 nm en vidrios que contienen alta proporción de CdO.

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RECII.2

Optical Characterization of an Electric Arc Used in the Preparation of Carbon Films

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Electric arcs have been widely used for the preparation of carbon films. In particular, the technique of filtered cathode arc is one of the best methods for the production of diamond-like carbon with high concentrations of sp^3 bonded carbon and, in 1999 an article in Nature reported the possibility of producing diamond micro-crystallites using high-power density pulses, ~60ms, generating electric arcs between two 0.5mm diameter graphite rods.
It is well known that the relative density of the precursors, as well as their spatial variation, energy, degree of ionisation, etc. determine the characteristics of the deposits produced by this type of method. With that in mind here we report optical studies: time resolved emission spectroscopy (identification of the emitted species at different delay times), time resolved photography (temporal and spatial evolution of the arc) and shadowgraphy (temporal and spatial evolution of the plasma and particle formation), of a pulsed arc similar to that used in the microcrystalline diamond work. Additionally, we report the preliminary results of the characteristics of the produced carbon films.

RECII.3

Características Ópticas de Películas de SiO_2 Obtenidas por Sol-Gel

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Se prepararon recubrimientos de SiO_2 sobre obleas de silicio por el método sol-gel. Las variables de depósito consideradas fueron: razón H_2O/TEOS, viscosidad de la solución, velocidad de retiro y temperatura de tratamiento. Los recubrimientos se caracterizaron utilizando espectroscopías de transmisión en el infrarrojo y de reflexión en la región UV-Visible. Para valores bajos de viscosidad es posible el depósito sólo con razones H_2O/TEOS bajas. Por otro lado, cuando la viscosidad de las soluciones son altas los recubrimientos presentan buena adherencia y homogeneidad en todos los casos. El espesor e índice de refracción del recubrimiento se obtienen del análisis de los espectros de reflexión. La dependencia de los parámetros anteriores con las variables de depósito, se relaciona con la estructura de la solución precursora y la competencia entre las razones de evaporación y condensación durante el depósito. Los espectros de infrarrojo del gel depositado presentan diferencias dependiendo de la razón H_2O/TEOS en la región de estiramiento (1000-1300 cm^{-1}) de los puentes Si-O-Si. El incremento en la temperatura de tratamiento refuerza los modos de balanceo, doblamiento y estiramiento de los grupos Si-O-Si. Las bandas asociadas a los grupos Si-OH (~950 cm^{-1}) y O-H (~3400 cm^{-1}), disminuyen en intensidad con el tratamiento térmico, siendo eliminados completamente a los 800°C. El modo de estiramiento asimétrico (~1150 cm^{-1}) asociado con desorden, disminuye considerablemente para dicha temperatura.

RECII.4

Caracterización Óptica y Estructural de Películas de SiO_2 Preparadas por el Método de Sol-Gel Conteniendo Níquel

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Se obtuvieron recubrimientos de SiO_2 utilizando la técnica de sol-gel conteniendo níquel en concentraciones de 10%, 20%, 30% y 40 % en peso como NiO. Las razones molares de etanol a TEOS y de agua a TEOS fueron de 4:1 y 11.7:1, respectivamente. Los recubrimientos se realizaron sobre substratos de vidrio y silicio. Los recubrimientos sobre substratos de silicio se realizaron sólo para concentraciones del 40%. Los recubrimientos fueron sometidos a tratamientos térmicos en atmósfera oxidante. Su estructura y propiedades ópticas fueron caracterizadas utilizando difracción de rayos X, espectroscopías de transmisión en el infrarrojo y de reflexión y transmisión en la región UV-visible. Los datos de transmisión óptica muestran para recubrimientos con concentraciones bajas de níquel una banda de absorción característica del Ni^{2+} de coordinación seis, siendo mas definida para temperaturas de tratamiento altas. En recubrimientos con grandes concentraciones de níquel, se presentan bandas de absorción correspondientes al Ni^{2+} con coordinación cuatro (tetraédrico) y seis (octaédrico). En estos últimos recubrimientos se observa también la presencia de oxido de níquel. La presencia del oxido de níquel se confirma en los difractogramas de rayos X y en los espectros de transmisión óptica. Los espectros de infrarrojo para recubrimientos sobre substratos de silicio muestran bandas asociadas con nitratos de níquel, las cuales tienden a desaparecer a temperaturas de tratamiento altas.

RECII.5

Biocompatible Zirconia Coating Prepared by the Spray Pyrolysis Method on Stainless Steel

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Thin ceramic films over metallic implant surfaces have to fulfill very strict requirements of chemical durability, biocompatibility and mechanical strength. In order to improve the mechanical and biological characteristics of zirconium oxide coatings on steel we present in this work the results of the production and structural characterization of zirconium oxide coats deposited on stainless steel. The coatings were produced by the Spray Pyrolysis method employing Zirconium-*n*-propoxide as precursor. Samples were grew up employing temperatures between 450-550 ºC, 0.05M-0.2M and under a 2ml/min continuos nitrogen flow. Samples were studied employing X-ray diffractometry, scanning electron microscopy, electron dispersive X-ray analysis and Raman sprectroscopy.

RECII.6

Study of The Evolution of Cobalt Species in Silica Xerogels

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Using X-Ray diffraction, infrared and visible absorption we have studied the microstructure of the silica xerogel powders when cobalt nitrate is incorporated. We paid attention to the evolution of the precipitated cobalt compounds into the SiO_2 matrix. Samples containing cobalt nitrate and prepared with a molar ratio of H_2O/TEOS of 11.66, were studied as a function of annealing temperature. We found that at relative high temperatures the cobalt compounds react with the silica matrix forming a cobalt silicate.

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RECII.7

Roughness Determination in Metallic and Glass Surfaces by Laser Light Scattering

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Roughness determination of surfaces without physical contact are important during fabrication of different kind of products. LLS signal was measured in tree set of samples, with different roughness and different chemical properties. Well known dependence of LLS signal with the roughness was quantified in terms of our own equipment. Considerations about spot light size, distance between source light and sample and incidence angle were analyzed. Also, oxidation process was monitored for stainless steel samples and plain iron. We have demonstrated the sensitivity of laser light scattering technique to determine surface roughness and oxidation processes. Potential applications to monitor smoothness of products during their fabrication and monitoring of oxidation processes, have been confirmed.

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RECII.8

Development of a Ceramic-Polymer Hybrid, Abrasion-Resistant Coating, to be Used on Wood

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In this paper, the results of designing, synthesizing and characterizing a ceramic-polymer hybrid, abrasion-resistant coating are presented. The polymer used is poly-methyl-meta-acrilate (PMMA), while the chosen ceramic particles are silicon (SiO_2). The new hybrid coating has an abrasion resistance 400% higher than a commercial one of the some type. The new coating has the some shine than the commercial one and is highly resistant to ultra-violet radiation.

RECII.9

Estudio de Recubrimientos Duros de TiN Fabricados por PVD- Arco Eléctrico, por Medio de AFM, XRD y XPS

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Recubrimientos de TiN se depositaron sobre sustratos de silicio en 2 orientaciones, (111) y (100), y carburo de tungsteno. Se depositaron usando un equipo PVD de evaporación por arco eléctrico. Los recubrimientos se fabricaron variando alguno de los parámetros principales de deposición como lo son: la diferencia de potencial aplicado al sustrato, el tiempo de depósito y el tipo del sustrato. Se mantuvieron constante algunos de los parámetros de fabricación como lo son: el potencial aplicado al cátodo, la presión parcial de los gases, la distancia del sustrato al cátodo, etc. Se realizaron caracterizaciones por medio las técnicas: difracción por rayos x, microscopia de fuerza atómica y espectroscopia de fotoelectrones de rayos X. Se analizó la evolución del tamaño de grano, el esfuerzo intrínseco biaxial promedio y la estequiometría del recubrimiento, al variarse los parámetros de fabricación.

RECII.10

Diseño, Construcción y Caracterización de un Sistema Antirreflector para un Láser de CO_2.

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Se propone la realización de una capa antirreflectora, sobre un substrato de ZnSe, que actuara como ventana de láser de CO_2; esta fuente tiene una línea de emisión en el I. R., donde la longitud de onda es de λ=10,6μm. Para tal propósito se encontró que el material adecuado es el CeF_3, teniéndose una capa de espesor óptico $ne=6\lambda_o$, donde λ_o=45nm para que se tuviera el acoplamiento deseado. A la vez, para poder caracterizar dicha capa, se creció, sobre uno de los espejos de un interferómetro de Michelson y así poder medir su espesor. Se presenta el proceso de crecimiento y los resultados experimentales de su caracterización.

RECII.11

Cathodoluminescent Characteristics of Al_2O_3 Thin Films and Powders Doped with Tb and Eu

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Cathodoluminescent characteristics of Tb and Eu doped aluminum oxide thin films deposited by spray pyrolysis technique have been studied as a function of the deposition parameters such as substrate temperature and dopant concentration. The spraying solution is prepared by mixing dimethylformamide with an aluminum organometallic compound. Tb and Eu doping is achieved by adding to the solution the organometallic compound in different concentrations. Al_2O_3 powders doped with Tb and Eu were prepared with terbium fluoride, europium chloride and aluminum nitrate as precursors at annealing temperatures of 500, 700 and 900°C. We studied the powders cathodoluminescent properties dependence on doping concentration and annealing temperature. We observe that the luminescent emission from Tb and Eu-doped thin films and powders have the spectral characteristics typical from radiative transitions among the electronic energy levels associated with the 3+ ionized states of these atoms. X-ray diffraction (XRD) patterns showed that Al_2O_3:Tb, Al_2O_3:Eu films and Al_2O_3:Eu powders are amorphous. Moreover, it is found that the broad amorphous component of the Al_2O_3:Tb XRD pattern is reduced as the annealing temperature is increased, crystalline peaks associated with the corundum phase from Al_2O_3 are observed. In addition, the surface morphology of the powders and films is studied by scanning electron microscopy and atomic force microscopy, respectively.

CMII.1

Mechanical Characterization of Layers Based on Transition Metals Nitrides (Ti, Al) Deposited by Reactive Sputtering

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One major application of nitrides is for cutting-tool coatings. In this case, hardness is important as well as adhesion, solubility in work piece and oxidation resistance
TiN, AlN an TiN/AlN bilayers have been grown on silicon and M5117 stainless steel substrates by reactive DC magnetron sputtering from titanium and aluminum targets in an $Ar+N_2$ atmosphere using a cathode power of 100W. Mechanical properties such as microhardness and Young's Modulus of the coatings were investigated using a Berkovich nano-indenter. Silicon substrates coated with a 3μm TiN layer showed hardness values twice higher than uncoated silicon. On a M5117 stainless steel substrate coated in the same way, the hardness measurements were three times higher. A similar study has been performed on AlN and TiN/AlN coatings and in this work we make a discussion about the possibilities of using this group of nitride compounds for hard coating applications.

CMII.2

Influence of Surface Thermal Conductivity on Transient Temperature Distribution

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We suggest an analytic calculation of transient temperature in a slab caused by a bulk absorption of a rectangular laser pulse. The pulse has the intensity I_0 and duration t . The irradiation is incident on the surface X=0 wich is characterized by some surface thermal conductivity η , the opposite surface X=l is kept by the ambient temperature T_0, the lateral sides are adiabatically insulated. The results show that the temperature distribution depends on three dimensionless parameters: the pulse duration $\gamma = \tau/\tau_0$, where $\tau_0 = l_2/\alpha$ is the caracteristic time of thermal diffusion, α is the thermal diffusivity; the degree of the light absorption $\delta = \beta l$, where β is the light absorption coefficient and the coefficient of the surface heat relaxation $\xi = \kappa/\eta l$, where κ is the bulk thermal conductivity. We have examined situations from the adiabatic insulation of the front surface X = 0($\xi \to \infty$) to the isothermic contact ($\xi \to 0$) for different parameters γ and δ. The temperature is maximum at the surface X = 0 if both the adiabatic condition and the surface absorption ($\delta >> 1$) are realized. This maximum is shifted inside the sample with the decrease of ξ and δ. The temperature amplitude is absent at the front surface in the case of the isothermic contact $\xi \to 0$). Some temperature anomalies connected with local space heating in the relaxation process ($t \geq \tau$, t is time) and the possibility of thermal diffusivity determination is discussed.

CMII.3

Quasi-one-Dimensional Excitons Confined By Electrostatic and Magnetic Fields

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We calculate variationally the ground state binding energy and oscillator strength of excitons in a GaAs-AlGaAs quantum well considering quantum confinement induced by lateral electrostatic effects and the presence of a magnetic field applied along the growth direction. We use the effective mass theory for the hamiltonian of electrons and holes, the envelope function method and a variational function to solve the Schroedinger equation. The effects of lateral electrostatic confinement are considered by the generation of coupled quantum wells with a parabolic shape whose width and height is modulated externally. We study the behavior of the exciton ground state and oscillator strength as functions of the magnetic field and the induced electrostatic quantum well widths. The exciton binding energy shows a strong dependence with the electrostatic confinement decreasing monotonically as the well width increases for a fixed value of the magnetic field, besides it also increases when the magnetic field intensity is stronger. By fixing high values of lateral electrostatic fields the exciton ground state energy shows a strong dependence with the magnetic field and the barrier width between coupled quantum wells. The oscillator strength intensity is so sentitive to variations of the magnetic field, lateral electrostic field and the barrier width.

CMII.4

Recombinación en los Semiconductores: Aparición de Portadores Fuera de Equilibrio debido a Inyección o Redistribución en la Muestra

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Se muestra que el método tradicional de la recombinación en el caso estático en ausencia de generación externa de portadores es contradictoria internamente. En algunos casos este método lleva a resultados obviamente incorrectos. Se muestran estos casos y se propone un nuevo método para la recombinación.

CMII.5

On the Kinetics of Si Cluster Incorporation in MBE Growing Silicon Thin Films

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The participation of small clusters in the growth of perfect crystalline thin films, as e.g. by molecular beam epitaxy, is now a generally accepted phenomenon in spite of the atomic nature of incorporation into a one-layer-at-a-time two-dimensional growth process. There is no reason, that in general a cluster, formed with more tan three atoms, adopts a two-dimensional appearance (although planar structures of e.g. carbon clusters are known). Such a crude picture already suggests that clusters do not incorporate in a crystal surface without changes of their inner bonding. Nevertheless is the question, whether a clusters adopts itself to the plane growing surface, maintaining more or less the original neighborhood of atoms, or it decays completely into single atoms, which now acquire mobility and independence from each other, is still unanswered.
We propose a procedure and an experimental technique, which should help to resolve this deficiency. Indeed is the knowledge of these processes important for the controlled deposition at high growth rate of perfect crystalline thin films. It might also shed light on the topic of the existence and efficiency of a near-surface transition layer in front of a growing film, where the mobility of incorporating species should be high. The most promising way of 'marking' the atoms in a cluster, might be the use of isotopes, which do not interfere with the physics and chemistry of crystal formation. Nuclear magnetic resonance (NMR) is a classic tool for the detection of nuclear paramagnetism, which is related to a nuclear spin present in a number of atoms. We discuss the application of ^{28}Si- and ^{29}Si-isotopes in clusters, where a difference of NMR-signals occurs for ^{29}Si-atoms surrounded by either (unmagnetic) ^{28}Si-atoms, or ^{29}Si-atoms surrounded by the same species on top of the growing film.

CMII.6

Thermoluminescence and Structural Characterization of New Phosphor Ceramics

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Thermoluminescence properties of new europium doped $KCl_XBr_{1-X}:Eu^{2+}$ type phosphors were investigated as a funtion of the relative composition X. We show that these phosphors exhibit better thermoluminesce properties than those of the alkali halides crystals of the same composition, for the case of X and UV radiation. The characterized samples were made from a mixture of KCl, KBr and Eu_2O_3 high purity powders. The mixed powder were first pressed at 6 ton for 10 minutes, and then sintered five hours at 700 ^oC. In both cases, for X and UV radiation exposure of the samples, the thermoluminescence response depends strongly on the composition X, and a notorious enhancement of the thermoluminescence intensity is obtained around X=0.3. The samples exhibit promising properties as detectors and dosimeters for X radiation and for UV radiation.

CMII.7

High Resolution Studies of Mineral Cementum

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Cementum is a unique avascular mineralized connective tissue that surrounds the root dentine and provides the interface through which the root surface is anchored to the collagen Sharpey's fibers of the periodontal ligament. Cementum inorganic matrix consists of 50% of hidroxiapatita crystal and the organic matrix consist of collagen types I and III, and proteins. The studies by use the optical microscopy showed two kind of root cementum: the acellular cementum and the cellular cementum. Recently by use of electron microscopy these two clasification were modified by inclued more characteristic with the presence or absense of cells and the reorganization of collagen fibers. The analitic and structural investigations of root cementum was been done in animal models with a high cientific relevance, but this results were impossible to extend to human models. The objetive of this investigation consist in determine the ultraestructure and physicochemicals propierties of the mineralized connective tissue of human tooth using hig resolution techniques as TEM, SEM and AFM.
The Ca/P ratio of the mineral-like tissue revealed values of 1.61 and 1.62 respectively. Electron diffraction patterns showed inner double rings that represent d-spacing which were consistent with those of hydroxyapatite and examination of the crystallinity with HRTEM showed homogeneous and preferential spatial arrangement of hydroxyapatite crystallites in the different types of cementum. Atomic force microscopy (AFM) images revealed small granular particles and grain agglomeration of crystalline plaques with a lamellar-like pattern of the mineral-like tissue. These findings indicated that cementum lineage present the same characteristic with them of the animal models.

CMII.8

Optical Setup to Characterize Optical Active Liquid Solutions

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Development of in-situ systems to measure parameters in real time, are necessary to control industrial processes. Some transparent organic compounds in solution have optical activity, rotation of polarization plane caused by different absorption between left and right circularly polarized light, which permits identify quantity and dynamic behavior of those compounds. We have built a experimental system based in a low cost commercial semiconductor laser and a photoelastic modulator. Sugar solutions with different concentration were measured to calibrate instrument. Sensitivity of 0.01 degrees in the angle of rotation of linear polarized light has been achieved. Important applications to monitor food processing like elaboration of alcoholic drinks which contain a fermentation process are discussed. Potential application of the technique, in transparent anisotropic thin films is also argued.

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CMII.9

Structural Characterization of $CdZn_xTe_{1-x}$ Thin Films

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$CdZn_XTe_{1-X}$ thin films were grown on corning glass substrate by the close space vapor transport combined with free evaporation technique (CSVT-FE) using coevaporation of CdTe and ZnTe. Zinc incorporation was controlled by the temperature of ZnTe source. The composition of the films were investigated by Auger electron spectroscopy and X-ray diffraction was used to evaluate the structural transition of CdTe to ZnTe. Optical properties were determined using transmission spectroscopy. The gap energy of the samples show a variation associated with the change in the ZnTe source temperature.

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CMII.10

Determinación de la Concentración de Sólidos Suspendidos por Dispersión de Luz

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La cuantificación de la dispersión de luz debido a partículas tiene importantes aplicaciones en fisicoquímica, meteorología y astronomía. En el presente trabajo se realizaron medidas de dispersión de luz debido a esferas de SiO_2, de tamaño arbitrario, suspendidas en agua y diferentes concentraciones, aplicando la teoría de Mie. La medidas se llevaron a cabo en una celda de vidrio con agitación magnética, con luz láser de Helio-Neón (λ = 632.8 nm) y un detector que puede girar angularmente. Se determinaron: la relación entre la concentración de sólidos suspendidos y la intensidad de dispersión, y la influencia del tamaño de la partícula sobre los resultados. Se desarrolló un programa de cómputo que calcula los coeficientes de dispersión, las eficiencias de dispersión, extinción y absorción, en función de parámetros ópticos (λ, n, k), basándose en la teoría de Mie. Los resultados obtenidos permiten desarrollar un sistema pueda determinar bajas concentraciones de sólidos suspendidos y determinar un perfil de tamaño de partícula simultáneamente.

CMII.11

Estudio de Gránulos Agregados de Almidón a Través del Análisis de Dispersión de Luz

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El almidón es un constituyente muy importante en una amplia variedad de alimentos. Muchas de las propiedades que determinan su calidad están relacionadas con el tamaño de partícula del almidón y su transformación debidos a procesos de cocimiento. En el presente trabajo se presenta el desarrollo de una metodología para el estudio del tamaño de partícula del almidón empleando dispersión de luz, así como los resultados de esta metodología aplicada al seguimiento del cocimiento de almidón de maíz. La metodología desarrollada para la preparación de muestras combinada con el uso de la técnica de dispersión de luz permite una gran reproducibilidad, que no habría sido posible de emplearse tamices o análisis de imágenes, lo permitió el estudio de procesos de agregación. Se emplearon cuatro líquidos dispersantes de diferente polaridad. Se observó que a mayor polaridad, mayor la eficiencia del líquido para la desintegración de agregados, y que las distribuciones, medidas para una misma muestra, dependen del líquido empleado. Agua demostró ser un líquido poco apropiado como dispersante para el caso de agregados de almidón, por su gran capacidad de desagregación y por ir incrementando el tamaño del gránulo sencillo. Los estudios de desagregación, mostraron la existencia de clases de agregados de diferentes tamaños.

CMII.12

Electrical and Optical Characterization of $Ge_2Sb_2Te_5$ Thin Films

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The transition from amorphous-to-crystalline phases has been investigated in $Ge_2Sb_2Te_5$ thin film. This material has been used for erasable optical memory devices. The phase transition was monitored in isothermal process at several temperatures using electrical impedance and optical (reflection and transmission) *in situ* measurements as a function of time. For this purpose the specially designed cell was developed. The Johnson-Mehl Avrani (JMA) theory was used to obtain the energy of activation *Ea* and the Avrami exponent *n* in each *in situ* measurements. It was shown that the optical measurements obey a linear relationship during the phase transformation as is commonly used in literature. However for the electrical resistance (the electrical resistance was obtained from low frequency impedance measurements) the volume fraction of crystallized material was obtained with the non-linear Maxwell -Wagner model for two phases. Received results have shown that impedance measurements are a new method (which never have been applied before to investigate the crystallization process in this material) which allow to receive the information about the new details of crystallization process in amorphous semiconductors.

CMII.13

Quick Method for Determination of Starch Gelatinization Temperature

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In this work we present a new method which allow determine starch gelatinization temperature from a dielectric dissipation thermal process. The method take advantages of the dielectric dissipation of electrical energy in the system, consisting of a mixture of starch and water enclosed in a specially designed sealed cell . AC electrical power at fixed voltage and frequency is applied to the material to be studied. The current is monitored as the temperature is raised up (by Joule effect) to temperatures of 120 °C. The plots of electrical current against temperature yields the onset and ending temperature for transformation changes in starch ie gelatinization process. The method demonstrates to be a useful technique for determine the basic parameters during starch gelatinization and it is much simpler than those known in the field. This method has been used for corn quality characterization in breeding programs.

CMII.14

Electrical Properties on Boron Doped Amorphous Silicon Films (a-Si-B:H)

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The electrical properties including dark, photoconductivities and conduction activation energy are measurements, have been made as a fuction of temeperature on a series of B doped amorphous silicon samples prepared by LPECVD decomposition of silane – diborane gas mixture at substrate temperature of 270°C. The incorporation of boron leads to an increase in the density of localized states lying 0.43 eV above the valence edge. The samples for the electrical conductivity measurements had coplanar electrodes with a separation of 2 mm. The contacts encountered they Ohmic of low resistance in the voltage range V≤15v use. Film thickness was 0.2-0.5 μm.
The effect of alloying on the dc conductivity of a-Si-B:H films in the temperature range of 150-500 K for samples with various X_g, it is observed that there is a wide range of temperature among which the conduction is an activated transport process. This could be interpreted by the continuosly activation of the carriers in the band tail state to mobility edge.

NANO.1

Electron Localization in Narrow Rough-Bounded Wires: Evidence of Different Surface Scattering Mechanisms

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The transmittance of ultra-quantum (single-mode) rough-bounded wires is calculated at in frames of Hamiltonian approach. The method for calculating dynamic characteristics of such conductors is developed which is based on two-scale representation of the electron propagator at weak scattering. The conductance as a function of the wire length L is shown to exhibit two regimes of electron transport. Specifically, they are the ballistic regime at $L << L_{loc}$ (L_{loc} is the electron localization length), where the dimensionless conductance $g \approx 1$, and the localized regime at $L > L_{loc}$ where the conductance falls exponentially with growing L. The applied method has given the opportunity to discriminate two fundamentally different competing mechanisms of electron-edge scattering, viz. by-height (BH) and by-slope (BS) scattering. Although BH scattering leads to conventional dependence of L_{loc} on r.m.s. height σ of the boundary defects, $L_{loc} \alpha \sigma^2$, while BS scattering gives $L_{loc} \alpha \sigma^4$, the latter mechanism is proven more likely to dominate even for the case of small in height and mildly sloping roughness. Through BS mechanism, the generically localized quantum states of electrons (so called evanescent modes) manifest themselves significantly, in contrast to the case of electron scattering related to bulk static inhomogeneities, e.g., impurities.

NANO.2

Electronic Properties of $ZnSe/Zn_{1-x}Cd_xSe/ZnSe$ Quantum Wells

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We calculate the energy levels for $ZnSe/Zn_{1-x}Cd_xSe/ZnSe$ quantum wells for different values of concentration x of Cd and well width (L_w). We use tight-binding approximations with base SP3S* for first neighbors interactions. In the calculation the approach of SGFM is used (Surface Green Function Matching). For the alloy the approach of the virtual crystal is used. We take account the strain in the interfaces.

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NANO.3

Nanostructured Molybdenum Bronzes

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There has been a growing interest in the synthesis of materials with nanoscale microstructures because of potential structural, magnetic and electronic applications. The common synthesis techniques are: chemical vapour deposition, chemical precipitation, sol-gel processing, gas-phase condensation, physical evaporation and sputtering. Sputtering seems to yield certain advantages with respect to the others techniques, such as, for instance, the possibility to prepare refractory materials and quaternary alloys.

Copper and its alloys have good electrical and thermal conductivity, good resistance to corrosion, special colours and ease of fabrication. Therefore, they are used more often than any other metal. The properties of copper and its alloys greatly depend on the amount of the alloying elements and even on small additions of impurities, hence the method of producing the copper alloys is very important and decisive for the final application. In this paper, we report on the synthesis of Cu/Mo alloy thin films by the magnetron sputtering technique at low gas pressure.

The sputtered material was investigated by means of X-ray diffraction, scanning electron microscopy, electron dispersion spectroscopy, atomic force microscopy and Vickers hardness tester. The results indicate that Cu/Mo alloys are semi-hard nanostructures with colours that change from black to yellow-golden when the Mo content increases. Hard nanostructured composite alloys were obtained at 500 ºC only at high Mo content. The yellow-golden alloys can be considered as molybdenum bronzes and can be used for integrated circuits (IC), electrical contacts, metallic resistors and high voltage sockets.

NANO.4

Growth Process of GaAs(N) Nanowhisker Thin Films

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GaN_xAs_{1-x} thin films made of whiskers were prepared by radio frequency magnetron sputtering technique; the films were grown on glass substrates in 100% nitrogen ambient at several substrate temperatures. Atomic force microscopy images revealed the whisker-shape of the grains whit nanometric dimensions. Images of films grew at constant temperature and different deposit times showed that the process of growth is similar to vapor-liquid-solid mechanism, where first condense drops of Ga on substrate surface and then solidify the compound inside the drops. The nitrogen concentration was determined to be in the interval 0.0055 – 0.0085. X-ray diffraction measurements allowed us to confirm the average grain size, which fluctuates in the range 4.0 – 4.5 nm.

NANO.5

Caracterización Óptica de Nanocompósitos de Ge/ZnO

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Se obtienen nanopartículas de Ge incorporado en una matriz de ZnO por la técnica de "Sputtering r.f." en ambiente de argón sobre substratos de cuarzo. Las nanopartículas se obtuvieron cambiando alternativamente blancos de Ge y ZnO y tratadas térmicamente a diferentes temperaturas. Las imágenes de TEM revelan la formación de nanopartículas de Ge en la matriz de ZnO. La variación de tamaño de las nanopartículas debida a la temperatura es observado en el espectro UV-Vis y TEM.

NANO.6

Optical Absorption of Colloidal Dispersion of Bimetallic Nanoparticles Au/Pd

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Colloidal dispersions of polymer-protected bimetallic nanoparticles were prepared by an simultaneous reduction method of their salts in presence of poly(N-vinyl-2-pyrrolidone). The results of absorption of bimetallic nanoparticles in the region UV-VIS to different Au/Pd molar ratio reveal that the colloidal dispersion prepared by simultaneous reduction are not a simple mixture of monometallic nanoparticles but the particles are composed of both metals Au and Pd. The analysis carried out on the absorption spectra of the bimetallic nanoparticles as a funtion of the Au/Pd molar ratio show that there exists a strong dependence between the size of particles and the value of the employed ratio of Au/Pd.

NANO.7

Optical and Structural Characterization of CdS Self-Assambled Nanostructures Produced by Pulsed Laser Deposition*

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The production of low-dimensional structures such as quantum wires or quantum dots (QDs) is one of the most attractive areas in semiconductor technology because of their potential application to high-efficiency opto-electronic devices such as very low-threshold semiconductor lasers. Until now, semiconductor self-assembled QDs have been fabricated with techniques like metalorganic vapor phase epitaxy and molecular beam epitaxy. The formation mechanism of self-assembled semiconductor nanostructures has been identified as the misfit strain involved in heteroepitaxial growth. We report results of the production, and optical and structural characterization of CdS nanostructures deposited by pulsed laser deposition on Corning glass substrates, two possible mechanisms for the production of these nanostructures are discussed: 1) stress at the heterojunction CdS/Corning glass due to differences in the thermal expansion coefficients and 2) the possibility that under the deposition conditions the ablated CdS from the target form droplets which then are directly deposited on the substrate.
The morphology of the deposited CdS layers was examinated by atomic force microscopy finding the presence of elliptic islands. The islands did not show any evidence of degradation with time or handling. A clear blue shift of the absorption edge with values up to 100 meV from the corresponding to a bulk-like film was observed in the room temperature transmission spectra. Room temperature modulated transmission measurements indicated a blue shift the only 7 meV. The differences between the results from transmission and modulated transmission spectroscopies are discussed taking in account the islands size distribution. These results are correlated with those obtained from10 K photoluminescence, x-ray diffraction and scanning electron microscopy measurements.

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NANO.8

Caracterización de Sulfuro de Cadmio Depositado Sobre Membrana de Huevo*

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Se crecieron sobre membrana de huevo tres películas de sulfuro de cadmio (CdS) utilizando el método de deposición en baño químico. Las películas obtenidas se caracterizaron por las técnicas de microscopia electrónica de barrido y fotoluminiscencia a temperatura ambiente. Las microfotografías muestran crecimiento de partículas de formas irregulares. La fotoluminiscencia presenta espectros de emisión que se extienden a energías superiores a la energía de banda prohibida del CdS monocristalino (2.42 eV). Mediante una deconvolución de los espectros de cada muestra, se determina con claridad líneas cuyos picos se ubican en 2.776 y 2.450, 2.713 y 2.478 y 2.704 y 2.508 eV respectivamente. Puesto que el tamaño nanométrico de las partículas incrementa la banda prohibida del material [1], esto modificará el espectro de emisión mostrando líneas en energías mayores a la del material en bulto. Estos resultados nos permiten decir que la membrana de huevo como matriz para el crecimiento, permite obtener cristales de tamaños nanométricos.
[1] T. Vossmeyer, L. Katsikas, M. Giersig, I. G. Popovic and H. Weller, J. Chem. Phys. **98** (1994) 7665.

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NANO.9

Characterization of CdS Clusters and Superclusters in A Type Zeolite

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The composite material consisting of CdS in a A type zeolite host was synthesized in alkaline aqueous solution at temperatures from 25 to 70 ºC, by using cadmium chloride and thiourea as reactive substances. We found that CdS loading in the zeolite is controlled by the reaction temperature. This method allow the low temperature synthesis of CdS clusters and superclusters in the zeolite, stable at ambient conditions. The diffuse reflectance spectra and scanning electron microscopy images of the samples were measured as a function of the reaction temperature. It was studied the evolution in the formation of CdS clusters and superclusters and the transition to CdS aggregates in the zeolite matrix. The absorption spectra of the samples prepared at lower temperature show the transitions due to CdS clusters and superclusters in the zeolite matrix at about 240 and 340 nm respectively. In the samples prepared at higher temperatures CdS synthesizes in the zeolite matrix as polycrystalline material with crystallite size depending on reaction temperature. A blue shift in the absorption edge of CdS is observed as consequence of particle size effects.

NANO.10

Synthesis of Self-Assembled InAs Quantum Dots Studied by Reflectance-Difference Spectroscopy

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A great interest in low-dimensional semiconductor structures originates from their exciting electronic properties that have an important impact on the performance of high speed electronic and photonic devices, and moreover, on the development of novel device concepts such as the single electron transistor. For instance, the quantum dots are nanometer-scale islands in which electrons and holes are confined in three-dimensional potential boxes. They are expected to exhibit a zero-dimensional δ-function density of states, and therefore to have superior characteristics for device performance in semiconductor lasers, detectors and modulators.

In the present work we report the growth of self-assembled InAs QDs on GaAs substrates, and on GaAs with a small amount of Si atoms deposited on the surface. The samples are characterized *in situ* by reflectance-difference (RD) spectroscopy, while atomic force microscopy (AFM) and photoluminescence (PL) were used as post-growth evaluation techniques. We observe that after the deposition of the QDs, the amplitude of the RD spectra increases dramatically as compared with the initial GaAs substrate RD spectra. These changes can be associated with variations in the anisotropy originated in the self-assemblage of the islands. Besides, we study the growth parameters that would drive us to control the size homogeneity and increase the density of these QDs.

NANO.11

Study of the Surface Morphology and Refractive Index in Porous Silicon Nanometric Films

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In the last years the porous silicon (PS) becomed of great technological interest. In this work we study the relationship between surface roughness and refractive index (n) of nanometric PS films.

We have studied freshly prepared PS films up to 150 nanometers in thickness. In characterizing we have used elipsometric, profilometric, gravimetric and atomic force microscopy (AFM) measurement techniques. The PS film surface roughness as a function of the anodization time and HF concentration in electrolyte is discussed in sight of the AFM film images. The results for the thickness obtained by ellipsometric measurements suggest a non-linear behavior of the etch rate for nanometric films as compared with thick films. In thin films a dependence of the refractive index with the thickness was not observed.

CIS.1

Discharge Cleaning and Wall Conditioning in a Novillo Tokamak

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Our Novillo Tokamak is a small toroidal device magnetically confined defined by the main design parameters: Ro = 0.23 m, av = 0.08 m, ap = 0.06 m, BT = 0.05-0.47 T, Ip = 1-12 kA, ne = 1-2 x 1013 cm-3, Te = 150 eV, Ti = 50 eV. For the discharge chamber cleaning we have often used baking up to 100 °C and then conditioning using Taylor Discharge Cleaning (TDC). In this work we report that vacuum baking is effective for obtaining a low base pressure in a short time when this process is employed in a system that has a final total pressure of less than 4x10-7 Torr. We have found that one parameter can be used to optimize the TDC method; we call this the Performance Parameter (PP). This parameter is ($Ip\tau$), where Ip is the peak to peak discharge current, τ is the plasma current duration. In graphs of PP versus the working pressure for different oscillator power, the maximum value of PP indicates the best cleaning conditions for TDC. The results of the vacuum chamber wall conditioning using this criterion are reported.

CIS.2

Preparation and Characterization of Platinum Palladium Catalyst Supported on Silica

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Catalysis is an extremely important phenomenon for our modern industrial economy, without it life today would be quite different from the reality we see around us. In heterogeneous catalysis all the action is at the outer layer of surface atoms of the catalyst. Hence, turning to surface science with its impressive array of spectroscopies, microscopies and diffraction techniques may appear as the obvious thing to do.
However catalysts are complicated multicomponent materials, often consisting of small particles that take care of catalysis, supported on an oxide support.
In this work, Catalysts of promoted Platinum and Palladium were prepared by impregnation of Platinum and Palladium onto silicon oxide. Catalyst sample were prepared from palladium clorure (0.2, 0.5 and 0.8 mmoles, Aldrich Chemical Co.) and acid hexacloroplatine (0.2, 0.5 and 0.8 mmoles, Aldrich Chemical Co.) and supported on Silicon oxide.
Studies of several issues, susch as preparation, and characterization using X-Ray Diffraction(X-RD), temperature programmed reduction (TPR), Transmision electron microscopy (TEM) and Energy Dispersive Spectroscopy (XEDS) was done, including the specific surface areas of the catalysts were measured using the BET method, by nitrogen adsorption at 198 K .

CIS.3

Thermal Response of a KNUDSEN-Type Effusion Source to Sudden Heating-Power Changes

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Effusion cells are the basis of nearly all beam sources used in condensed phase molecular beam epitaxy (MBE), although laser-radiation and electron-beam heated sources have also been successfully applied in the growth of certain materials. The temperature of KNUDSEN-type effusion sources is usually adjusted by radiation from a resistance-heated source. The heater is conventionally a refractory metal wire (Tantal) wound noninductively either spirally around the crucible or from end to end supported inside insulating tubing. A thermocouple is used to provide for temperature control, and must be placed in a position, e.g. the base of the crucible, in order to provide for a realistic measurement of the cell temperature. The precise control of evaporation and growth rates requires a temperature stability of not less then 0.1% at a base temperature of 1000 °C. This high standard makes a detailed knowledge of the thermal properties of the effusion sources indispensable. The relation between heating power and source temperature characterizes the stationary behavior, where the use of radiation shields allows to reduce considerably the electrical input. The temperature transition function for a step increase in heating power displays the most important information about the dynamical behavior of the source. In the present paper an experimental study and model calculations of the response of KNUDSEN-type effusion sources to a step-like change of the heating-power are carried out. It is found, that for small temperature differences the transition function follows approximately an exponential law after some constant delay time has passed. Heat radiation and heat conduction, including of the evaporating material, form the main contributions to the time constant involved.
[1] A. Zehe, A. Thomas: "*Tecnología Epitaxial de Silicio*" (ISBN 3-8311-1438-2); ed. Intercon, www.libri.de, Alemania 2000.

CIS.4

Calculations of a Correction Matrix of AES Depth Profiling for the Interface AlGe/n-GaAs

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The quantitative Auger electron spectroscopy (AES) depth profiling requires the conversion of measured signal intensity into a true concentration value. The evaluation of correction matrix was chosen for the quantification of AES depth profiling for the interface AlGe/n-GaAs. The correction factors to take into account were the electron backscattering correction factor and the inelastic mean path. The electron inelastic mean free path was calculated from experimental optical data and from the predictive formula TPP-2 [1] for electron energies ranging from 200-2000 eV. The electron backscattering correction factor was estimated using Monte-Carlo simulations. The uncertainties in the correction matrix were estimated based on the uncertainty of the correction factors. We conclude that the applied methods are robust and useful for predicting inelastic mean path and for estimating the backscattering correction factor for electron energies up to 2000 eV. The resulting quantitative AES depth profiling of the interface AlGe/n-GaAs confirm that the proposed correction matrix method is more accurate than the conventional one based on the use of sensitivity factors. Finally, a true concentration value versus sputter time is presented.

[1] S. Tanuma, C.J. Powel and D.R. Penn. *Surf. Interface Anal.* **17**, 911 (1991).

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CIS.5

Photoluminescence and *In-Situ* RHEED of Ultra-Thin CdSe Quantum Wells*

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We present results on the growth and characterization of ultra-thin quantum wells (UTQWs) obtained by molecular beam epitaxy (MBE) in pulsed mode, a technique often called ALE (Atomic Layer epitaxy) or MEE (Migration enhanced epitaxy). The UTQWs were grown in a RIBER 32P MBE system onto semi-insulating GaAs(001) substrates. UTQWs with thickness ranging from 1/2 to 4 monolayers (ML) of CdSe were grown by ALE (1ML=a_{CdSe}/2=3.038 Å) between ZnSe barriers at substrate temperatures of 260 and 290 ^{o}C. In each sample, five similar QWs separated by barriers of around 200 Å thick were deposited onto a 5000 Å buffer layer of ZnSe. The Zn/Se and Cd/Se beam pressure ratio was kept ~1/3 and the growth rate for MBE ZnSe was ~0.7 μm/h. To improve bidimensional growth 15 cycles of ALE ZnSe preceded the growth of every CdSe QW.
During the growth process the surface reconstruction was monitored *in- situ* by reflection high energy electron diffraction (RHEED) and the diffraction patterns recorded using a video camera. The RHEED patterns were recorded in the azimuths [110], [100] and [1-10]. The exposure time of each cell (Cd, Se) was 15 s and the dead time was 5 s. The RHEED pattern images were digitized and the analysis of the streak positions indicated a critical thickness around 1.5 ML. A 2D growth mode was observed in all the UTQWs.
The structures were characterized by temperature dependent photoluminescence spectroscopy (PL) in the range from 15 to 300 K. The samples exhibited intense luminescence in the blue-green region of the spectrum. The energy of the emission presented a clear dependence on growth temperature and QW thickness. Samples grown at 290 ^{0}C are blue shifted with respect to those grown at 260 ^{o}C. This effect can be explained in terms of i) Cd- Zn interdiffusion between wells and barriers, or, ii) reduction of the sticking coefficient of Cd leading to a thinner QW at higher substrate temperatures. The behavior of peak energy position and full width at half maximum as a function of temperature indicates that more than one transition is present in the emission; these multiple transitions cannot be explained in terms of thickness fluctuations of the ultra-thin QWs.

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CIS.6

Influence of the Surface Waves on the Transmission Coefficient in Piezo-Composites

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We study some properties of piezo composites made of layers of different piezoelectric materials. In particular, we discuss the existence of surface waves in the interfaces between the layers. In particular, we discuss the existence of the surface waves in the interfaces between the layers. We analyze their influence on the transmission coefficient, the displacement amplitude, and the potential. We study also the influence of the angle of incidence and frequency of the external waves. For the case of periodic samples we obtain a band structure and, when this periodicity is broken, by adding a linear term in the values of the piezoelectric parameters, the band structure is destroyed and Stark-Ladder Resonances appear instead.

CIS.7

Native Ga_{As} Antisite Defects in LPE-Grown GaAs Layers and Neutralized by Sn Doping

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We have grown Sn-doped GaAs epitaxial layers for a width range of Sn concentration of 10^{16}-10^{18} cm^{-3}, and we have characterized their optical properties using the photolumines-cense(PL) and photoreflectance(PR) spectroscopies. The PR spectra show a broadening of the PR lineshape as the Sn concentration in the layers increase, and an increase in the surface electric field as a result of the high doping. The PL spectra measured in this same set of samples show that as the Sn doping in the layer increases, there is a systematic decrease in the intensity of the antisite-related low energy PL band and that this band disappears for concentrations of around 10^{18} cm^{-3}. Besides, for concentrations of the order of 10^{18} cm^{-3} there appears a shoulder in the PR lineshape at low energies which evolves to a well defined additional transition for the highest-doped sample. We discuss these results from the PL and PR spectra in terms of a neutralization mechanism between the antisite defects and the donors introduced when Sn atoms enter in Ga sites, and the appearance of the additional oscillation in the PR spectrum probably due to a band filling effect.

EI.1

Medición de Parámetros Ópticos en Películas de a-$Si_{1-x}C_x$:H

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Dispositivos basados en películas de a-$Si_{1-x}C_x$:H (carburo de silicio hidrogenado) tales como celdas solares, presentan un coeficiente de absorción muy alto, a su vez, los dispositivos emisores de luz requieren materiales con altos coeficientes de absorción para su fabricación, es por esto que estamos interesados en la medición de parámetros ópticos (coeficiente de absorción, ancho de banda, índice de refracción) de esta película y utilizar éstos como un método de selección de la película para la fabricación de dispositivos emisores de luz. La medición de los parámetros se realiza mediante un programa de computo basado en el método de Swanapoel. Presentaremos un análisis de resultados obtenidos de películas de carburo de silicio depositadas bajo diferentes condiciones.

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EI.2

Design and Construction of a Compact Monoblock for Gas Phase Mirage Effect Spectroscopy

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We have developed a monobloc cell based on mirage effect (Photothermal beam Deflection, PTD) spectroscopy for trace gas detection in a variety of practical applications capable of real time mesurements at the ppb an sub-ppb level in controlled environments or in open air. Our pricipal objective of this design have been in improve the sensitivity and flexibility of operation, while incluiding a new alternative for a gas detection systems. We discuss the implication of our design and construction choices and discuss many practical apllications of it instrument.

EI.3

The Fabrication Process Effects Over Clock Distribution Networks

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The implementation of integrated circuits involves satisfying the constraints of a number of performance parameters (e.g. delay, area, power consumption, etc.). In addition, in actual submicron technologies issues like crosstalk and ground bounce have become critical; this is mainly due to the higher operating frequencies and higher density of integration.
The optimization of Clock Distribution Networks (CDN) in Very Large Scale Integration (VLSI) is a widely studied problem under many constraints. Previous works neglect some variables (cost, crosstalk, ground bounce, etc.), the problem is not covered at all or do not consider topology and process variations as part of the CDN problem. The importance of the parameter variations from the fabrication process over most of the performance parameters is that their increasing effects as the minimal dimension shrinks. Thus, it is important to investigate if these variations are critical factors for those performance parameters.
In this work, the behavior of different CDN topologies under fabrication process variations (interconnection width, metal resistance, threshold voltage, oxide thickness and its electric permitivity) and design variations (interconnection width, buffer design, capacitive loads and couplings, and clock rising-times) has been analyzed at the four more used CDN. The topologies are compared between there and guidelines to optimize a variable for each topology are stated**.**

EI.4

Diseño y Construcción de un Espectro-Analizador en el Visible, para Caracterizar Películas Metálicas Delgadas

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Las técnicas de análisis de superficies metálicas delgadas como conductividad, transmitancia y reflectancia, permiten caracterizar las propiedades de estos materiales y comercialmente existen dispositivos que obtienen datos utilizando las técnicas mencionadas anteriormente. Sin embargo, consideramos que para fines didácticos y en aplicaciones tecnológicas y posiblemente de investigación, es necesario contar con equipo, que sin sacrificar la precisión de las mediciones, sea fácilmente accesible e incluso con posibilidades de ser construido en los laboratorios de instituciones de educación superior del país. Por ejemplo, este tipo de equipos servirían en la industria para controlar *in situ* propiedades de las películas metálicas delgadas y para procesos de control de calidad. Por lo anterior, en este trabajo reportamos el diseño y construcción de un dispositivo que al iluminar con radiación monocromática películas metálicas delgadas, permite medir la transmitancia de esas películas, en función de la longitud de onda incidente. El dispositivo consiste en una fuente emisora de luz con una fuente de luz blanca, un prisma y, como receptor, un fotodetector en el visible. Utilizando este dispositivo realizamos la caracterización de películas delgadas de oro, plata, cobre y aluminio, midiendo la transmitancia en función de la longitud de onda. Mostramos gráficamente los resultados obtenidos para películas de diferentes grosores. Como método comparativo para probar la precisión de nuestro dispositivo, realizamos la caracterización de la transmitancia óptica de las mismas películas usando un láser de He-Ne (λ = 632.5 nm).

EI.5

Plasma Spectra Analysis Using Bidimensional Acquisition With Fiber Optics

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Two plasma assisted deposition techniques are analyzed using an optical fiber array, a spectrograph and a ICCD. The plasma electron density (N) and temperature (T) are estimated assuming statistical equilibrium, relating them with the spectral line intensity ratio. We present details of the instrumentation, its calibration, as well as examples on deposition of thin films with sputtering and laser ablation. A better understanding of the evaporation conditions will help to improve and control the characteristics of the resulting film.

EI.6

Implementación de Circuitos Analógicos Empleando Transistores MOS de una Compuerta Flotante y Múltiples Compuertas de Control

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La implementación de los transistores MOS de compuerta flotante y múltiples compuertas de control conocido como MICFGTs, ha sido sumamente favorable. La configuración de un circuito amplificador operacional empleando MICFGTs en la etapa diferencial sirve como base para afirmar que la su implementación trae consigo múltiples ventajas en cuanto a desempeño y versatilidad se refiere si este se compara con un amplificador operacional convencional; citando las más relevantes de dichos dispositivos, resulta imprescindible mencionar que es posible tener "n" señales de entrada por cada dispositivo esto evita definir estructuras repetitivas para obtener una respuesta similar empleando MOS convencionales, en función de ello se ahorra área al definir el circuito; además es posible definir varias combinaciones de los voltajes de entrada de dicho dispositivo que pongan en conducción al mismo debido a ello su implementación en circuitos analógicos trae consigo un desempeño y versatilidad mayor.

Por otro lado resulta importante mencionar que fue necesario el desarrollo de un modelo a través del cual fuese posible realizar las simulaciones eléctricas correspondientes en las que se evalúa el desempeño del dispositivo y de los circuitos analógicos que se evaluaron empleando el nuevo dispositivo como parte de su configuración. La utilidad de dicho modelo queda demostrada al comparar los datos obtenidos en la simulación con respecto a los cálculos obtenidos de un circuito sumador, empleando un solo par diferencial y la etapa de salida respectivamente.

EI.7

Semi-Analytical Modeling of the Cryogenic Self-Heating of Silicon Integrated Devices

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Since the thermal conductivity and the specific heat of crystalline solids decrease significantly with the lowering of the temperature, it is believed that the self-heating, which is due to the Joule heating during electrical operation, becomes stronger under cryogenic conditions. This strong cryogenic self-heating can lead to an undesirable increase in the device's temperature well above the ambient temperature. Several semiconductor parameters such as charge carrier and ionized impurity concentrations, mobility, carrier lifetime, as well as the transport mechanisms, which are strongly dependent on the operating temperature, are thus affected during the operation.
Thus, the modeling of the cryogenic self-heating of semiconductor devices becomes a fundamental issue since the localized variations of the device's temperature can significantly alter the device performance at low temperatures. In spite of the several experimental reports of the cryogenic self-heating of silicon devices, little effort, if any, has been expended in order to quantify the local temperature rises. The thermal resistance, which not only depends strongly on temperature but also on the geometry and material properties, has not been modeled.
This work presents a semi-analytical approach to modeling the thermal resistance of an integrated silicon device making possible to quantify its steady-state self-heating from room temperature down to liquid helium temperatures. This model considers the temperature dependence of the silicon's thermal conductivity and allows for the separation of this temperature dependence from the geometrical features of the sample.

Acknowledgements
CONACyT, Mexico, supported this work under grant I32891-A.

EI.8

Verification of Binary Logic Functions of XOR and X-NOR Gates Using MOSFETs with Floating Gate

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The use of floating gate MOS transistors has an important influence in the performance of electronic circuits as programmable inversors, volatile and non-volatile memories, etc. The circuit we analyze herein uses device called νmos transistor, which simulates the behavior of a bological neuron, for that reason it is called neuron MOS (νmos). This neuron is made up of multiple control or input gates having a capacitive interaction with the floting gate. Teh system of the floating transistors with multiple input gates has an equivalent circuit formed for each control gate. Hence, a voltage applied over each input gate induces a voltage upon the floating gate, having therefore a linear voltage addition on it. Under this principle and with the use of a digital.analog converter (D/A), several programmable inversors and a MOS neuron, logic gates can be implemented whose output can be any of the siteen boolean functions. This can be done with the same circuit configuration , but only changing the external voltage signals, what is called Soft Hardware Logic Circuits. In addition to thid advantage, there is also a decrease in silicon area used when fabricated. In this work, we report the design and simulation of logic gates, using a universal circuit with floating gate MOS transistors.

EI.9

Sistema de Redes Neuronales Dinámicas Aplicadas a Control de Biorreactores

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El desarrollo de algoritmos de control basados en Redes Neuronales Dinámicas (RND), son aplicados a un Biorreactor en Lote Alimentado, en este se muestra que a pesar que la dinámica del proceso de fermentación es complicada debido a su no linealidad, el sistema es llevado a un valor de referencia establecida. La experimentación se realizo con un proceso de fermentación de *Sacharomices cereviseae*, en un biorreactor de 5 l. En este trabajo, se presentan la metodología desarrollada, así como la eficiencia del sistema de identificación y control, mediante la evolución de los estados de concentración de biomasa, concentración de sustrato de alimentación y volumen.

EI.10

The First Cesium Molecular Beam Clock Developed in Latin America: High Accuracy Evaluation of Systematic Effects

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Currently and since 1967, the International System of units (SI) defines the time unit, the second in terms of an internal property of an atom: the energy difference between the two hyperfine levels of the ground state of the cesium–133 atom. The National Center of Metrology in Mexico has developed the first experimental device in Latin America, called CsOp-1 with the objective to reproduce the second with an accuracy of the order of 10^{-14} seconds. To reach this accuracy levels has been necessary to take in account the effects that modify the energetic difference in the hyperfine energy levels of the ground state of the cesium atom and evaluate the magnitude of the systematic shifts in the frequency ν associated to the difference between this hyperfine levels by the Plank equation $E=h\nu$. Among this effects are the followings: second-order Zeeman effect, black body radiation, relativistic effects, and others. In this work we present a high accuracy evaluation of this systematic effect in the level of parts in 10^{14}, and also the evaluation of the associated uncertainties. Currently the CsOp-1 is under frequency stability evaluation by making comparisons with another atomic clocks at the CENAM's Time and Frequency Division.

EI.11

Diseño y Construcción de un Dispositivo para la Medición de Densidad de Portadores de Carga Mediante Termopotencia

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Usando un termo cooler basado en el efecto Peltier para crear gradientes térmicos en muestras de películas delgadas semiconductoras, se diseña un dispositivo de bajo costo para la medición de densidad de portadores de carga mediante la técnica de Termopotencia. La medición de carga se hace a través de un amplificador de instrumentación de ultra alta impedancia limitado en banda para la reducción de ruido. Para la limitación de banda se utiliza un osciloscopio digital con capacidad de promedio. El dispositivo se prueba en muestras de CdS dopadas con diferentes tipos de iónes.

EI.12

Celda de Memoria Sináptica EEPROM

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En este trabajo se presenta la simulación de una celda sináptica construida utilizando un nuevo transistor funcional llamado Neuron MOS uniendo una celda de memoria EEPROM de compuerta flotante dentro de un circuito seguidor fuente diferencial de nuevo concepto. Ya que su función es bastante análoga a la neurona biológica, el dispositivo es llamado Neuron MOSFET (neuMOS o *v*MOS). El transistor funcional es compuesto de una compuerta flotante y múltiples compuertas de entrada que están capacitivamente interactuando con dicha compuerta flotante, el dispositivo calcula la suma ponderada de sus señales de entrada a nivel compuerta. La sinapsis puede representar pesos positivos (excitatorios) o negativos (inhibitorios) bajo una sola fuente V_{DD}, como la operación suma es realizada a nivel compuerta en modo de voltaje utilizando el efecto de acoplamiento capacitivo, esencialmente es libre de disipación de potencia, haciéndolo un dispositivo ideal para implementarse en ULSI. Una excelente linealidad en la actualización de pesos ha sido obtenida.

EI.13

Diseño y Construcción de una Trampa Magneto Óptica para Átomos de Cesio 133

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El Centro Nacional de Metrología (CENAM) ha diseñado y construido una trampa magneto-óptica (MOT) con el objeto de transmitir de manera controlada momento lineal de fotones a átomos de Cesio-133 para enfriarlos a temperaturas del orden de 140 μK sobre el cero absoluto y posteriormente utilizar la estructura multi-energética de estos átomos y gradientes de polarización para disminuir su temperatura hasta valores de 3 μK sobre el cero absoluto transformando energía cinética en radiación electromagnética. En este trabajo se esbozan los principios de operación de la MOT y se presenta el diseño y construcción de las partes que la componen: el sistema de vacío que opera a 10^{-9} Torr, el sistema óptico para producir fotones con dispersión en frecuencia de 1MHz, el sistema de control de frecuencia de los fotones utilizando moduladores acústico-ópticos. Así mismo se presentan los resultados preliminares en la operación de la MOT.

EI.14

On-Line Monitoring of Atmospheric Ethene in Mexico City by Photoacoustic Spectroscopy

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A CO_2-laser-based photoacoustic spectrometer was used to monitor atmospheric ethene in Mexico City. Measurements were performed on-line from 5:OO to 23:00 h, during 7 consecutive days in February 2001. Typically, ethene concentration starts increasing around 6:00 h, from a nocturnal background level of less than 5 ppbV, as a result of an increasing emission of car exhausts. Maximum concentrations of approximately 70 ppbV are measured around 8:00 h, from which point a decreasing concentration is observed. These results have been correlated with data of other pollutants like e.g. NO_2 and O_3, as well as wind speed and direction, obtained from a local monitoring net (RAMA).

Sociedad Mexicana de Ciencia de Superficies y Vacío A. C.

XXI Congreso Nacional

1 al 5 de Octubre
Mazatlán, Sinaloa
México, 2001

CURSOS CORTOS
SHORT COURSES

CC.1

Fundamentals of Creating and Maintaining a Vacuum

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The fundamentals of creating and maintaining vacuum for high technology processes will be described. The discussion will begin with a brief history of the development of vacuum and the ideal gas law. The velocity, impingement rate, and molecular mean free path of an ideal gas will be related to phenomena in a vacuum, and used to develop the concepts of volumetric flow rate, pumping speed, conductance and throughput. The concepts of viscous and molecular flow regimes will be developed and related to operation of vacuum systems. The types of pumps used to create and maintain vacuums will be described, including wet and dry roughing/backing pumps, and high vacuum diffusion, turbomolecular, cryo and getter ion pumps. The gauges appropriate to measurement of vacuum will be discussed, including roughing gauges, high and ultrahigh vacuum gauges, residual gas analyzers, and mass flow contollers. Hardware used in vacuum systems will be reviewed. Finally, vacuum system pump down curves will be illustrated and related to materials selection, outgassing and leaks. Procedures to reduce outgassing by baking and cleaning will be described.

CC.2

Surface and Materials Microcharacterization and Analysis

C.R. Brundle
Director of Defect and Thin-Film Characterization Laboratory, Applied Materials

The course concerns materials characterization, as applied to surfaces, thin films, and interfaces. It is based on a two day American Vacuum Society course with the same name, and on the text book " Encyclopedia of Materials Microcharacterization" by Brundle, Evans and Wilson. In the AVS course, and the book, the principles and typical uses of 50 techniques used in materials analysis are described. Most are surface and microanalytical methods. Some are not usually thought of as being surface sensitive but are included because there are ways to make them more so, or because they provide complementary information. In this shortened version of the course the major surface analysis methods are covered (XPS, Auger, SIMS) plus ion scattering techniques and comparison is made to some of the other methods that are widely used in the high tech materials industries (SEM/EDX, IR/Raman, STM/AFM) where ultra-thin films are involved. The course notes for the full AVS course are provided.

CC.3

Mini Short Course on Thin Film Epitaxial Growth: Mechanisms and Kinetics

Joe Greene
University of Illinois

Course objectives

* Understand the primary experimental variables and surface reaction paths controlling nucleation/growth kinetics and microstructural evolution during vapor-phase deposition.
* Develop an appreciation of the advantages/disadvantages of competing growth techniques.
* Learn how to better design film growth processes.

Course description

Thin-film technology is pervasive across many fields of modern technology including microelectronics, optics, magnetics, hard and corrosion resistant coatings, micromechanics, etc. Progress in each of these areas depends upon the ability to selectively and controllably deposit thin films (thickness ranging from tens of angstroms to micrometers) with specified physical properties. This, in turn, requires control -- often at the atomic level -- of film microstructure and microchemistry. Essential fundamental aspects, as well as the technology, of thin-film nucleation and growth from the vapor phase (evaporation, MBE, sputtering, and CVD) are discussed in detail and highlighted with "real" examples. The course begins with an introduction on substrate surfaces: structure, reconstruction, and adsorption/desorption kinetics. Nucleation processes are treated in detail using insights obtained from both in situ (RHEED, LEED, STM, AES, EELS, etc.) and post-deposition (TEM and AFM) analyses. The primary modes of nucleation include 2D (step flow, layer-by-layer, and 2D multilayer), 3D, and Stranski-Krastanov. The mechanisms and kinetics of epitaxial growth in the 2D step-flow, layer-by-layer, and multilayer growth modes will be discussed in detail using examples from experiments, simulations, and theory. Transitions among these growth modes as well as the fundamental limits of epitaxy will also be discussed. The results from this part of the course will then be used to describe heteroepitaxy and the role of film/substrate misfit strain. Topics in this section include film-stress relaxation mechanisms (misfit dislocations, self-organized island formation; film critical thicknesses), quantum dot engineering, and superlattices.

Chapter 1. **Introduction: surface structure and processes**
Chapter 2. Nucleation
a) Thermodynamics
b) Kinetics
Chapter 3. 2D step flow and layer-by-layer growth
a) Mechanisms and kinetics
b) Transitions
Chapter 4. 2D multilayer growth
a) Mechanisms and kinetics
b) Fundamental limits
Chapter 5. Heteroepitaxy and the role of strain
a) Relaxation mechanisms
1. Misfit dislocations, critical thickness
2. Surface roughening, islanding, S-K growth
b) Quantum dot engineering
c) Superlattices

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