

## DS 24 Postersitzung II

Zeit: Dienstag 17:00–19:00

Raum: Poster TU B

DS 24.1 Di 17:00 Poster TU B

**Nonlinear optical coefficients from first-principles calculations: Different numerical approaches** — ●ROMAN LEITSMANN, W.G. SCHMIDT, P.H. HAHN und F. BECHSTEDT — Institut für Festkörpertheorie und -optik, Friedrich-Schiller-Universität Jena, Max-Wien-Platz 1, 07743 Jena, Germany

Different numerical and methodological approaches for the ab initio calculations of the nonlinear optical response are used in the literature[1,2]. On the one hand, the formulas used are not easily seen to be equivalent. On the other hand, the numerical results even for well characterized bulk systems like GaAs do neither agree well with each other nor with experiment[3]. We revisit the derivation of the relevant expressions for the second harmonic generation (SHG) and show analytically the equivalence of the approaches[1,2] within the independent-particle approximation. In addition, we develop an approach to include excitonic effects in the SHG spectra over a wide energy range. Numerical results for bulk GaAs are presented which show the large influence of technical parameters on the final results.

[1] J.L.P. Hughes and J.E. Sipe, Phys. Rev. B 53, 10751 (1996).

[2] B. Adolph and F. Bechstedt, Phys. Rev. B 57, 6519 (1998).

[3] S. Bergfeld and W. Daum, Phys. Rev. Lett. 90, 036801 (2003).

DS 24.2 Di 17:00 Poster TU B

**Surface optical anisotropy induced by water molecules adsorbed on Si(001): First-principles calculations** — ●KAORI SEINO and WOLF G. SCHMIDT — Institut für Festkörpertheorie und -optik, Friedrich-Schiller-Universität, Max-Wien-Platz 1, 07743 Jena, Germany

Water is a major component in the residual gas in most ultra-high vacuum apparatus. Water coadsorption therefore occurs on many Si(001) surfaces to a noticeable degree. The interaction of water with Si(001) surface has also been discussed in the context of type-C defects on Si(001) surfaces. Here we present reflectance anisotropy spectra (RAS) for water covered Si(001) surfaces calculated within the independent particle approximation. We mainly discuss two configurations: the dissociative adsorption (i.e. the formation of HO-Si-Si-H) and the oxygen insertion into the Si dimer (i.e. the formation of H-Si-O-Si-O). For low coverages we find essentially an attenuation of the RAS features typical for clean Si surfaces. For the saturation coverage of one molecule per dimer, however, dissociative adsorption and oxygen insertion into the Si dimer give rise to clearly different optical anisotropies.

DS 24.3 Di 17:00 Poster TU B

**Anharmonic decay of optical phonons in III-V semiconductors at temperatures up to 1200 K** — ●EUGEN SPEISER<sup>1</sup>, TORSTEN SCHMIDTLING<sup>2</sup>, and WOLFGANG RICHTER<sup>1,2</sup> — <sup>1</sup>Department of Physics, University of Rome Tor Vergata, Via della Ricerca Scientifica 1, I-00133 Rome, Italy — <sup>2</sup>Institut für Festkörperphysik TU Berlin, PN 6-1, Hardenbergstr. 36, 10623 Berlin, Germany

The anharmonic decay of optical phonons into lower frequency phonons is a fundamental process for energy relaxation in semiconductors. It manifests itself in the phonon linewidth which can be obtained from Raman scattering experiments. By measuring then the temperature dependence of the Raman linewidth the contribution of different decay processes can be tested. This has been done until now only for some elemental semiconductors. Comparable high temperature experiments on compound semiconductors have been rarely reported until now since their surfaces decompose and deteriorate easily at high temperatures. This surface deterioration leading to wrong results can be avoided by providing stabilisation of the volatile surface component by epitaxial stabilisation.

We have therefore combined a MOVPE(Metal Organic Vapour Phase Epitaxy) apparatus for III-V semiconductor growth with a Raman setup via a glasfibre to guide the inelastic scattered light from the sample inside reactor to the Raman spectrometer. We report first studies of the crystal anharmonicity done by Raman spectroscopy on stabilised GaAs and InAs surfaces at high temperatures. We will compare these results with literature data on the atomic mean square displacements obtained by x-ray diffraction.

DS 24.4 Di 17:00 Poster TU B

**Optimisation of MOVPE growth of InN with spectroscopic ellipsometry** — ●M. DRAGO, C. WERNER, T. SCHMIDTLING, M. PRISTOVSEK, U.W. POHL, and W. RICHTER — TU-Berlin, Institut für Festkörperphysik, Hardenbergstr. 36, 10623 Berlin

Because of the poor quality of the available InN layers, fundamental properties of this material (i.e. the value of the bandgap energy) are still under discussion. Consequently, there is a strong demand to improve the InN epitaxial layers. We have grown InN on sapphire (00.1) in MOVPE, studying the dynamics of the processes and the optical properties with in-situ spectroscopic ellipsometry (SE). In this work we report on the effect of substrate preparation, nucleation layer thickness and different growth parameters. Our results led to an improved procedure where the temperature is increased after nucleation and V/III ratio is decreased down to 10000 during growth at 580°C. This allows growth rates as high as 350 nm/minute. The samples produced are presently among the best in the MOVPE niveau. The resulting mobility was 600 cm<sup>2</sup>/Vs and the FWHM for the X-ray diffraction 2- $\theta$  scans in the 00.2 reflection was lower than 150 seconds.

DS 24.5 Di 17:00 Poster TU B

**Origin of the optical anisotropy oscillations during the oxidation of Si(001)** — ●FRANK FUCHS, WOLF G. SCHMIDT, and FRIEDHELM BECHSTEDT — Institut für Festkörpertheorie und -optik, Friedrich-Schiller-Universität Jena, Max-Wien-Platz 1, 07743 Jena, Germany

The oxidation of silicon is both of great fundamental and technological interest. Despite decades of effort, the microscopic mechanisms of oxide growth are still under consideration. Recent experiments [1-4] indicate the high potential of Reflectance Anisotropy Spectroscopy (RAS) for the study of oxide growth on Si(001), where RAS could represent a powerful supplement to conventional surface characterisation techniques.

Here we present the results of our ab initio study on the origin of the RAS oscillations measured during oxide growth. Our results demonstrate the relation of the RAS oscillations to the layer-by-layer oxidation of Si(001). The major contribution to RAS is found to result from the interface, while the RAS signal from the oxide-overlayer is found to vanish due to surface disorder. The progression of the local strain field accompanying the oxygen-insertion into Si-Si bonds at the interface is identified as the actual origin of the RAS oscillation.

[1] T. Yasuda *et al.*, Phys. Rev. Lett. **87**, 037403 (2001).

[2] T. Matsudo *et al.*, J. Appl. Phys. **91**, 3637 (2002).

[3] T. Yasuda *et al.*, Phys. Rev. B **67**, 195338 (2003).

[4] T. Yasuda *et al.*, Thin Solid Films **455-456**, 759 (2004).

DS 24.6 Di 17:00 Poster TU B

**Comparative studies of interactions between intense pulsed laser and gold nanoparticles in water and toluene phases** — ●ZHANGQUAN PENG<sup>1</sup>, THOMAS WALTHER<sup>2</sup>, and KARL KLEINERMANN<sup>1</sup> — <sup>1</sup>Institut für Physikalische Chemie und Electrochemie I, Heinrich-Heine-Universität Düsseldorf, 40225 Düsseldorf, Germany — <sup>2</sup>Center of Advanced European Studies and Research, Ludwig-Erhard-Allee 2, 53175 Bonn, Germany

Gold nanoparticles were surface-modified with a pH-sensitive monolayer of 4-aminothiophene (4-ATP) in water phase. By varying the pH value of the solution, nanoparticles could be quantitatively transferred into toluene phase in a two-phase (water/toluene) system. The nanoparticles in both water and toluene phase were irradiated by an intense pulsed laser at 532 nm. The products in solution were examined by transmission electron microscopy (TEM) and optical absorption spectroscopy. Besides, the effects of the presence of excess protecting ligands including 4-ATP and SH(CH<sub>2</sub>)<sub>8</sub>SH on the photo-fragmentation kinetics and product morphology have been studied. Experimental results showed that gold nanoparticles in toluene phase are more prone to be photo-fragmented into small metallic clusters than in water phase, independent of the existence of protecting ligands. The dielectric and heat conduction properties of the solvents have been invoked to explain the observed phenomena.

DS 24.7 Di 17:00 Poster TU B

**Optical anisotropy of clean and adsorbate modified vicinal Si(001) surfaces** — ●REGINA PASSMANN<sup>1,2</sup>, MATTHIAS WAHL<sup>1,2</sup>, MICHAEL GENSCHE<sup>1,3</sup>, KARSTEN HINRICHS<sup>1</sup>, PATRICK VOGT<sup>2</sup>, WOLF GERO SCHMIDT<sup>4</sup>, WOLFGANG RICHTER<sup>2</sup>, and NORBERT ESSER<sup>1</sup> — <sup>1</sup>ISAS - Institute for Analytical Sciences - Department Berlin, Albert-Einstein-Str. 9, D-12489 Berlin — <sup>2</sup>TU Berlin, Institut für Festkörperphysik, Hardenbergstr. 36, D-10623 Berlin — <sup>3</sup>Gesellschaft zur Förderung angewandter Optik, Optoelektronik, Quantenelektronik und Spektroskopie e.V., Rudower Chaussee 29, D-12489 Berlin — <sup>4</sup>Friedrich-Schiller-Universität Jena, Institut für Festkörperphysik und -optik, Max-Wien-Platz 1, D-07743 Jena

Reflectance anisotropy spectroscopy (RAS) is well suited to investigate the anisotropy of optical and electronic properties of solid surfaces. In agreement with ab-initio calculations the geometric and electronic structure of the surface can be determined. The optical anisotropy of the clean vicinal Si(001) surface and the modification in the optical anisotropy during adsorption of organic molecules was investigated. A model of the adsorption geometry for cyclopentene monolayers on the vicinal Si(001) surface could be verified. The sample was prepared under ultra high vacuum and characterised by RAS, XPS and LEED. Comparison with ab-initio calculation shows that cyclopentene most probably adsorbs via a cycloaddition reaction with the Si dimer [1].

[1] W.G. Schmidt, F. Fuchs, A. Hermann, K. Seino, F. Bechstedt, R. Paßmann, M. Wahl, M. Gensch, K. Hinrichs, N. Esser, S. Wang, W. Lu, J. Bernholc, J. Phys. C 16 (2004), S4323

DS 24.8 Di 17:00 Poster TU B

**Multichannel RAS – a versatile means for fast in situ measurements** — ●CH. KASPARI, S. WEEKE, F. POSER, M. PRISTOVSEK, and W. RICHTER — Technische Universität Berlin, Institut für Festkörperphysik, Sekr. PN 6-1, Hardenbergstraße 36, D-10623 Berlin

Reflectance anisotropy spectroscopy (RAS) has become an important *in situ*-technique for the study of epitaxial growth of semiconductor surfaces and interfaces. However, for growth monitoring on a short time scale (order of seconds and below) one is usually restricted to transient measurements at one single photon energy.

We report on a special RAS setup that is designed to measure transients at multiple photon energies simultaneously in the spectral range between 1.4 and 5 eV. A variety of processes in III-V-MOVPE were investigated with this setup, e.g. oxide desorption and quantum dot growth.

DS 24.9 Di 17:00 Poster TU B

**The dielectric properties of organic heterostructures compared to mixed layers** — ●DANIEL LEHMANN, M. FRIEDRICH, A. FECHNER, and D.R.T. ZAHN — Institut für Physik, Technische Universität Chemnitz, Reichenhainer Straße 70, D-09107 Chemnitz, Germany

Zinc phthalocyanine (ZnPc) and fullerene C<sub>60</sub> are used in organic solar cells as p- respectively n-conducting materials. They can be deposited as individual layers in a heterostructure or as mixed (homogeneous or gradient) structures. The purpose of this work is to determine the differences in the optical properties of the various structures. ZnPc and C<sub>60</sub> were evaporated respectively coevaporated on silicon substrates using Organic Molecular Beam Deposition (OMBD) in ultra high vacuum. The layers were studied *ex situ* with Variable Angle Spectroscopic Ellipsometry (VASE). The dielectric properties were obtained by fitting the ellipsometric data. The differences in the optical properties of the distinct structures are discussed with regard to the application in solar cells.

DS 24.10 Di 17:00 Poster TU B

**Influence of superlattice structure on the optical properties of organic materials** — ●SASCHA HERMANN, OVIDIU GORDAN, MARION FRIEDRICH, and DIETRICH ZAHN — Institut für Physik-Halbleiterphysik TU-Chemnitz, D-09107 Chemnitz, Germany

While the optical properties of inorganic superlattices are well known there is so far only very little work on organic superlattices. This work deals with the preparation and investigation of multilayered organic heterostructures. The organic superlattices of alternating layers consist of 3,4,9,10-perylenetetracarboxylic dianhydride (PTCDA) and copper phthalocyanine (CuPc). Samples were prepared by organic molecular beam deposition in high vacuum on H-passivated Si(111) kept at room temperature. Typical thicknesses of individual layers are in the range of 2.5-10nm. The samples were studied by spectroscopic ellipsometry in the range of

0.73 to 5eV and infrared spectroscopy (IR). The IR-results reveal that there is no chemical interaction between the constituents at the interface. The evaluation of the ellipsometry measurements however reveal that the optical response can not be described by superimposing the optical response of single layers. This suggests that there is electronic coupling between the orbitals of the PTCDA and CuPc at the interface.

DS 24.11 Di 17:00 Poster TU B

**Applications of synchrotron infrared ellipsometry for analysis of small samples and heterogeneous films** — ●MICHAEL GENSCHE<sup>1,2</sup>, KATY RODENKO<sup>1</sup>, ULLRICH SCHADE<sup>3</sup>, ARNULF RÖSELER<sup>2</sup>, ERNST-HEINER KORTE<sup>1</sup>, KARSTEN HINRICHS<sup>1</sup>, and NORBERT ESSER<sup>1</sup> — <sup>1</sup>ISAS - Institute for Analytical Sciences, Albert-Einstein-Str. 9, 12489 Berlin — <sup>2</sup>GOS e.V., Rudower Chaussee 29, 12489 Berlin — <sup>3</sup>BESSY, Albert-Einstein-Str. 15, 12489 Berlin

It was shown recently that the detection limits of infrared ellipsometry can be improved to monolayer sensitivity by use of appropriate measurement strategies and dedicated radiation sources such as synchrotron infrared beamlines [1]. Another question is if also biological or other samples with considerable spatial variations of the optical and chemical properties can be investigated with this method. The evaluation of the anisotropic optical constants [2] and of the structural parameters (e.g. molecular orientation) of such samples requires an understanding of the contributions due to deviations from the commonly applied layer models. This work shows that small and heterogeneous samples can be investigated with respect to thickness, structure and composition. It is outlined how different contributions such as roughness, varying thickness and chemical properties can be separated by applying the optical models, in particular if a highly brilliant source is used.

[1] M. Gensch, K. Hinrichs, U. Schade, A. Röseler, E.H. Korte, Anal. Bioanal. Chem. 376 (2003) 626. [2] K. Hinrichs, M. Gensch, K. Sahre, K.-J. Eichhorn, N. Esser, U. Schade, A. Röseler, E.H. Korte, Appl. Spectrosc. 57 (2003) 1250.

DS 24.12 Di 17:00 Poster TU B

**Raman identification of the in-plane axes of zincblende (100) surfaces: Basic principles and application to II-VI / III-V heterostructures** — ●T. MUCK<sup>1</sup>, J.W. WAGNER<sup>2</sup>, J. GEURTS<sup>2</sup>, and V. WAGNER<sup>1</sup> — <sup>1</sup>School of Engineering and Science, International University Bremen, Campus Ring 8, D-28759 Bremen, Germany — <sup>2</sup>Physikalisches Institut, EPIII, Universität Würzburg, D-97074 Würzburg, Germany

We use the interference of deformation-potential- and Fröhlich-induced Raman scattering from LO phonons in zincblende materials to identify the in-plane axes of zincblende (100) surfaces and interfaces. This procedure, which allows e.g. to distinguish between the [011]- and the [0-11] direction, is demonstrated experimentally for n- and p-type GaAs(100). The main potential of the method is its application to heterostructures. Here it allows the unambiguous assignment of polarized Raman scattering features from surfaces and interfaces to their characteristic symmetry directions. Two examples are presented: (i) localized vibrations of CdSe monolayers, embedded in BeTe stacks, and (ii) vibration modes of Te dimers on clean (2x1) reconstructed BeTe(100) surfaces.

DS 24.13 Di 17:00 Poster TU B

**Characterization of ruthenium dyes for organic solar cells with Raman and SERS micro-spectroscopy** — ●CARMEN PÉREZ LEÓN<sup>1</sup>, LOTHAR KADOR<sup>1</sup>, BIN PENG<sup>2</sup>, and MUKUNDAN THELAKKAT<sup>2</sup> — <sup>1</sup>University of Bayreuth, Institute of Physics and Bayreuther Institut für Makromolekülforschung (BIMF), 95440 Bayreuth — <sup>2</sup>University of Bayreuth, Macromolecular Chemistry I, 95440 Bayreuth

Ruthenium(II) complexes containing polypyridyl ligands have been widely studied as potential photosensitizers in organic solar cells. Of particular interest is their use in dye-sensitized solar cells based on nanocrystalline films of TiO<sub>2</sub>. We have investigated the new dye Ru-TPA<sub>2</sub> with amino ligands and the well-known N719 complex with thiocyanate moieties. The influence of the solvent on the adsorption of the complexes on colloidal nanoparticles and their spectroscopic properties have been studied. The electronic transitions of both dyes show solvatochromic shifts due to specific interactions of the ligands with the solvent molecules. The surface-enhanced Raman (SER) spectra of the dyes dissolved in water, ethanol, and acetonitrile were measured in silver and gold colloidal solutions. The results show that the dyes are adsorbed on the metallic nanoparticles in different ways for different solvents. Deprotonation, H-bonding, and donor-acceptor interactions seem to determine these differ-

ent behaviors. Furthermore, experiments in which the dyes are adsorbed on TiO<sub>2</sub> were also performed, showing characteristics of the binding of the sensitizers to the semiconductor surface.

DS 24.14 Di 17:00 Poster TU B

**Ellipsometric investigation of valence band and core level excitation in thin nitride films** — ●MUNISE RAKEL<sup>1</sup>, CHRISTOPH COBET<sup>1</sup>, RÜDIGER GOLDHAHN<sup>2</sup>, KARSTEN FLEISCHER<sup>1</sup>, WOLFGANG RICHTER<sup>1</sup>, and NORBERT ESSER<sup>3</sup> — <sup>1</sup>Institute of Solid State Physics, TU Berlin, Hardenbergstr. 36, D-10623 Berlin — <sup>2</sup>Institute of Physics, TU Ilmenau, D-98648 Ilmenau — <sup>3</sup>ISAS Institute for Analytical Sciences Berlin, Albert-Einstein-Str. 9, D-12489 Berlin

The dielectric function of GaN and InN in hexagonal and cubic crystal structure has been measured in a spectral range from 3- 30 eV using ellipsometry at BESSY II. Hexagonal a-plane InN(11-20) and m-plane GaN(1-100) were used to access both the ordinary and the extraordinary part of the dielectric tensor. Especially for GaN, the m-plane is the more preferable surface for quantum well structures because of the absence of any polarization along the growth axis [1]. In addition, we determined the optical properties of cubic crystal nitrides to provide a critical test for the various theoretical models. We observed a strong optical anisotropy in the higher interband transitions and core level excitations of a-plane InN and m-plane GaN in dependence of the sample orientation. Above 15eV the optical spectra of GaN and InN are dominated by transitions between the 3d/4d atomic orbital and the conduction bands. We compared measurements at RT and 12 K using a closed cycle helium cryostat setup. Composition and temperature related energy shifts are reported for InN, GaN and AlGaN.

[1] P.Waltereit, O.Brandt et al.; 1. Selected Brief Reports; Paul-Drude-Institut Berlin

DS 24.15 Di 17:00 Poster TU B

**Surface and layer properties of MOVPE-grown InN** — ●S. J. SIMON<sup>1</sup>, R. EHLERT<sup>1</sup>, M. DRAGO<sup>1</sup>, C. WERNER<sup>1</sup>, N. ESSER<sup>2</sup>, P. VOGT<sup>1</sup>, and W. RICHTER<sup>1</sup> — <sup>1</sup>TU Berlin, Institut für Festkörperphysik, TU Berlin, Hardenbergstr. 36, 10623 Berlin — <sup>2</sup>Institute for Analytical Sciences, Department Berlin, Albert-Einstein Str. 9, 12489 Berlin

The formation of indium clusters/droplets and the incorporation of oxygen in InN films during growth is still an open question. Here, we study epitaxial InN layers with thickness between 20 nm and 350 nm MOVPE-grown on sapphire substrates using ammonia and trimethylindium as precursors. Atomic force microscopy images indicate closed layers and x-ray diffraction (XRD) confirms crystalline perfection of the films.

The InN samples are studied in Ultra High Vacuum after surface deoxidation by annealing at approximately 450°C. Surface and layer properties are investigated by soft x-ray photoemission spectroscopy (SXPS), scanning tunneling microscopy (STM) and scanning tunneling spectroscopy (STS). The formation of suspected In cluster or droplets in the films and the incorporation of oxygen is analyzed by SXPS. Variations of the fundamental bandgap energy are determined by STS.

DS 24.16 Di 17:00 Poster TU B

**Influence of magnetic field on the growth of vanadyl phthalocyanine thin films on Si(111) substrates** — ●V. KOLOTOVSKA, G. SALVAN, O. D. GORDAN, C.C. HIMCINSCHI, M. FRIEDRICH, and D.R.T. ZAHN — Institut für Physik, Technische Universität Chemnitz, D-09107 Chemnitz

Research on materials like Vanadyl Phthalocyanine (VOPc) which exhibits large optical nonlinearity and ultra fast response is of great importance for the design of novel devices for optical applications. The device quality depends on molecular orientation, which can be influenced e. g. by a magnetic field during film growth. In this work VOPc films with thickness between 10-100 nm were grown on H-Si(111) substrates by evaporation in high vacuum. The substrates were kept in a homogenous magnetic field (up to 1.3 T) perpendicular to the sample surface. Spectroscopic Ellipsometry and Infrared Spectroscopy were employed for the characterisation of the optical properties and the molecular orientation. The molecules deposited without magnetic field are found to have a small tilt angle with respect to the substrate, while those deposited in magnetic field tend to orient with their C-rings parallel to the field direction, following the proposal in reference [1].

[1] T. Mori et al., Thin Solid Films 366 (2000) 279.

DS 24.17 Di 17:00 Poster TU B

**Composition and thermal stability of thin functional oxidic (Pr, La, Y) and metallic (Ru, Ti) layers on Si and SiC substrates** — ●ANDRIY STYERVOYEDOV, IOANNA PALOUMPA, and DIETER SCHMEISSER — Angewandte Physik - Sensorik, BTU Cottbus, Konrad-Wachsmann-Allee 17, 03046 Cottbus, Germany

Thin Pr-, La- and Y- based oxide layers for applications as gate dielectric in metal-oxide-semiconductor (MOS) structures are investigated with x-ray photoelectron spectroscopy. The films with a thickness of around 2nm have been prepared on Si and SiC wafers by various chemical deposition methods based on nitrate solutions. In addition, we report on Ti- and Ru- based metal contacts prepared in the same way. The film composition is analysed and annealing steps in vacuum up to 900°C have been applied to test their thermal stability. The interface characteristics, surface composition and thermal stability of MOS functional multilayers have been studied and will be presented.

DS 24.18 Di 17:00 Poster TU B

**Spectroscopic ellipsometry study of thin carbon films** — ●PAVEL TOLSTYKH<sup>1</sup>, SVIATOSLAV SHOKHOVETS<sup>2</sup>, and GERHARD GOBSCH<sup>2</sup> — <sup>1</sup>BNTU Minsk, Skaryna Prosp. 65, 220027 Minsk, Belarus — <sup>2</sup>Institute of Physics, TU Ilmenau, PF 100565, 98684 Ilmenau, Germany

Spectroscopic ellipsometry studies of thin carbon films deposited on silicon and quartz substrates by sputtering of a graphite target using a Nd-glass pulse laser were carried out. We observed a strong dependence of the dielectric function of the films on deposition regimes such as substrate temperature and laser pulse energy during deposition, as well as annealing temperature and duration. The experimental data were analysed using reference dielectric functions for graphite-like and diamond-like carbon films. The results obtained indicate that structural properties of the films depend on deposition and thermal treatment conditions. In particular, the content of graphite phase increases with increasing substrate temperature and laser pulse energy. Further we compare properties of laser deposited carbon films to plasma deposited ones doped with copper and discuss regimes to grow films suitable for various applications.

DS 24.19 Di 17:00 Poster TU B

**Thermisch aufgedampfte, epitaktische Eu:LuSc2O3-Filme auf alpha-Al2O3** — ●LUTZ RABISCH, STEFAN EHLERT, SEBASTIAN BÄR und GÜNTER HUBER — Institut für Laser-Physik, Luruper Chaussee 149, 22761 Hamburg

Alpha-Al<sub>2</sub>O<sub>3</sub> ist ein bewährtes Material für optische Anwendungen. In Kombination mit Sesquioxiden wie Lu<sub>2</sub>O<sub>3</sub> oder Sc<sub>2</sub>O<sub>3</sub> können kristalline, wellenleitende Schichtsysteme für vielseitige Anwendungen hergestellt werden.

Wir stellen Eu:(Lu/Sc)2O<sub>3</sub>-Schichten vor, die mit dem Elektronenstrahl-Verdampfungsverfahren auf Alpha-Al<sub>2</sub>O<sub>3</sub> Substraten aufgebracht wurden. Die Substrate sind in (0001)-Richtung orientiert. Dadurch ist Gitteranpassung zu in < 111 >-Richtung aufwachsenden Schichten möglich. XRD und Oberflächen-XRD Messungen bestätigen, dass die Schichten epitaktisch aufgewachsen sind. Spektroskopische Untersuchungen zeigen, dass erst bei ultradünnen Schichten ( $d < 10\text{nm}$ ) Abweichungen von der Symmetrie von Volumenkristallen auftreten. Im Gegensatz zu EBV-deponierten Y<sub>2</sub>O<sub>3</sub>-Schichten sind die (Lu/Sc)2O<sub>3</sub>-Schichten stabil, was Kristallstruktur und spektroskopische Eigenschaften betrifft.

DS 24.20 Di 17:00 Poster TU B

**Reflectance anisotropy spectroscopy extended into the IR and VUV spectral range** — ●MATTHIAS WAHL<sup>1,2</sup>, KARSTEN FLEISCHER<sup>1</sup>, SANDHYA CHANDOLA<sup>1</sup>, NORBERT ESSER<sup>2</sup>, and WOLFGANG RICHTER<sup>1</sup> — <sup>1</sup>Technische Universität Berlin, IFP, Sekr. PN 6-1 Hardenbergstr. 36, 10623 Berlin — <sup>2</sup>Institute for Analytical Science, Department Berlin, Albert-Einstein Str. 9, 12489 Berlin

Reflectance anisotropy spectroscopy (RAS) is often used as tool to monitor anisotropic surface structures. With good understanding of these also molecular assemblies on surfaces are more and more analysed with RAS. Usual set-ups only operate in the visible spectral range (1.5 - 6 eV). We present new RAS systems which are extended into the infrared and also into the VUV regime to an effective range of (0.5-9 eV). Possible origins of RAS signatures are discussed, particularly a free electron like response from one dimensional metallic structures in the IR and also signatures arising from molecular adsorbates in the UV range.

DS 24.21 Di 17:00 Poster TU B

**Laserablation von  $\text{Cu}_2\text{Ta}_4\text{O}_{12}$ -Filmen** — ●ROBERT LUX<sup>1</sup>, ANDREAS HEINRICH<sup>1</sup>, BERND STRITZKER<sup>1</sup>, BERND RENNER<sup>2</sup>, STEFAN EBBINGHAUS<sup>2</sup> und ARMIN RELLER<sup>2</sup> — <sup>1</sup>Institut für Physik, Experimentalphysik IV, Universität Augsburg, 86135 Augsburg — <sup>2</sup>Lehrstuhl für Festkörperchemie, Universität Augsburg, 86135 Augsburg

Materialien mit einer hohen Dielektrizitätskonstante erlauben Bauelemente mit kleineren Kapazitäten. An diesen besteht speziell im Bereich der mikroelektronischen Geräte ein hohes Interesse. In möglicher Kandidat für eine hohe Dielektrizitätszahl ist  $\text{Cu}_2\text{Ta}_4\text{O}_{12}$  (CTaO). Aus diesem Grund wurden dünne Schichten von CTaO -in Koexistenz mit  $\text{Ta}_2\text{O}_5$ - mittels gepulster Laserablation auf Si(100) Substraten abgeschieden. Es zeigte sich, dass sowohl die kristalline Struktur, als auch die Oberflächenmorphologie der CTaO-Filme stark von Substrattemperatur, Sauerstoffdruck und Target-Substrat-Abstand abhängen. Des weiteren wurde festgestellt, dass sich vor dem eigentlichen Wachstum vom CTaO eine  $\text{Ta}_2\text{O}_5$ -Schicht bildet, auf der das CTaO in verschiedenen Orientierungen aufwächst. Wir berichten über Details der Filmdeposition und der Analyse der Filmeigenschaften mittels Rasterelektronenmikroskopie, Transmissionselektronenmikroskopie, Enegeidispersiver Röntgenanalyse und Röntgenbeugung.

DS 24.22 Di 17:00 Poster TU B

**Growth and microstructure of polymer-metal composites prepared by pulsed laser deposition** — ●JOHANNA RÖDER, JÖRG FAUPEL, and HANS-ULRICH KREBS — Institut für Materialphysik, Universität Göttingen, Friedrich-Hund-Platz 1, 37077 Göttingen

Polymer-metal composites have a wide range of applications. Heading towards new materials with tailored properties, understanding of growth behaviour is one of the main goals. Using pulsed laser deposition it is possible to prepare such different material classes as polymers and metals in a one-step process. Samples were prepared in an UHV chamber at room temperature using a KrF excimer laser at 248 nm. The matrix for later cluster growth was Polymethylmethacrylate (PMMA) or Polybisphenol-A-carbonate (PC). The polymers were analysed by FTIR and X-ray reflectometry. The embedded metal clusters consist of Ag, Cu or a combination of Ag/Cu or Ag/Nb, and were mainly characterized using TEM. Different scenarios such as the growth of pure Ag or Cu on PC or PMMA, and furthermore the influence of Cu or Nb acting as a seed for later cluster growth will be presented and discussed.

DS 24.23 Di 17:00 Poster TU B

**Laser-induced periodic structures in plasma polymer films with embedded metal nanoparticles** — ●KATRIN LÖSCHNER<sup>1</sup>, ANDREAS KIESOW<sup>1</sup>, ANDREAS HEILMANN<sup>1</sup>, AMIN ABDOLVAND<sup>2</sup>, and GERHARD SEIFERT<sup>2</sup> — <sup>1</sup>Fraunhofer-Institut für Werkstoffmechanik, Heideallee 19, 06120 Halle — <sup>2</sup>Fachbereich Physik, Martin-Luther-Universität Halle-Wittenberg, 06099 Halle

A laser-based method to generate grid-likely arranged line structures in thin organic films with embedded gold or silver nanoparticles is introduced. The films with a thickness of about 100 nm were deposited by alternating plasma polymerization of hexamethyldisilazane and metal evaporation to obtain a multilayer structure, i.e., all particles are arranged in one plane within the plasma polymer matrix. Irradiating these samples with linearly polarized, ultrashort (130 fs) laser pulses leads to the formation of periodically arranged, line-like areas with modified particle size and shape distribution. The films were irradiated with different laser wavelengths (800 nm, 400 nm, 528 nm, 266 nm). Transmission and scanning electron microscopy (TEM, SEM) were applied to analyze the microstructural changes. A linear dependency between the structure period and the wavelength used is observed. The direction of the particle lines correlates to the linear polarization of the laser pulses. The anisotropic structure modifications result in dichroic film properties. The structure changes and the physical mechanism of the periodic formation are discussed.

DS 24.24 Di 17:00 Poster TU B

**Abscheidung von ZnO mittels Pulsed Laser Deposition auf Saphir** — ●MARTIN BECK — Martin Beck Talstrasse 18 07743 Jena

Die Abscheidung von Zinkoxid mittels Pulsed Laser Deposition von Zink-Target und ZnO-Target auf Saphir (1-102) und Saphir (0001) wird untersucht. Die Abscheidungsparameter Substrattemperatur und Sauerstoffdruck werden variiert. Die Schichten werden mit Röntgendiffraktometrie, RBS sowie optischer Transmissionsmessung untersucht. Anhand des  $C_{\text{min}}$ -Werts des RBS-Zinksignals und Leitfähigkeitsmessungen soll die

Rolle von Zn-Interstitials für die n-Leitung von ZnO abgeschätzt werden.

DS 24.25 Di 17:00 Poster TU B

**Mechanism of pulsed laser deposition of PMMA** — ●ERIK SÜSKE<sup>1</sup>, THORSTEN SCHARF<sup>1</sup>, THOMAS JUNKERS<sup>2</sup>, MICHAEL BUBACK<sup>2</sup> und HANS-ULRICH KREBS<sup>1</sup> — <sup>1</sup>Institut für Materialphysik, Universität Göttingen, Friedrich Hund-Platz 1, 37077 Göttingen — <sup>2</sup>Institut für Physikalische Chemie, Universität Göttingen, Tammannstraße 6, 37077 Göttingen

Polymer thin films of sub-micrometer thickness of poly (methyl methacrylate) (PMMA), polytetrafluorethylene (PTFE) or polyethylene (PE) are attractive coating materials. Desirable hardness and wear resistance are mostly obtained by cross-linking polymer films. The pulsed laser deposition offers a versatile method to grow thin PMMA films which consist of two components, one fraction with a molecular weight well below that of the target material and a second fraction, which is cross-linked. Both, the molecular mass and the amount of cross-linking are tunable by the deposition parameters as substrate temperature and laser fluence which gives the opportunity to deposit films with excellent properties. In this contribution, the deposition mechanism of PMMA is discussed with respect to characteristics as microstructure, chemical composition and mechanical properties.

DS 24.26 Di 17:00 Poster TU B

**Laser-carburizing of austenitic stainless steel** — ●MICHAEL KAHLE<sup>1</sup>, ETTORO CARPENE<sup>2</sup>, SALVATORE CUSENZA<sup>1</sup>, and PETER SCHAAF<sup>1</sup> — <sup>1</sup>Universität Göttingen, II. Physikalisches Institut, Friedrich-Hund-Platz 1, D-37077 Göttingen, Germany — <sup>2</sup>Dipartimento di Fisica, Politecnico di Milano, Piazza Leonardo da Vinci 32, I-20133 Milano, Italy

Austenitic stainless steel is still an interesting material. Its grand corrosion properties are superimposed by the poor wear properties. Laser plasma treatments in reactive atmospheres have gained a large potential for technical applications, especially for surface coatings. The work pieces can be covered with hard, resistant carbides whose amount and structure is dependent of the processing parameters: Gas-pressure, number of pulses and energy. The structural, mechanical and chemical changes of the carburized surfaces are investigated by means of Rutherford Backscattering Spectrometry (RBS), Conversion Electron / X-Ray Mössbauer Spectroscopy (CEMS/CXMS), Nanoindentation and X-Ray Diffractometry (XRD). The results such as phase formation, carbon incorporation, hardness and stress are presented. A comparison with magnetron-sputtered austenitic stainless steel will be given. The main focus is the supersaturated fcc-structure (expanded austenite).

DS 24.27 Di 17:00 Poster TU B

**Herstellung dünner  $\text{Cu}_2\text{O}$  Schichten mittels gepulster Laserablation** — ●KERSTIN WÄTJE, ANDREAS HEINRICH und BERND STRITZKER — Universität Augsburg, EP IV, Universitätsstr. 4, 86135 Augsburg,

Die Methode der gepulsten Laserdeposition (PLD) erlaubt die Herstellung verschiedenster Materialien in Form dünner Filme. Ein aktuelles Forschungsgebiet stellt dabei die Optoelektronik dar.

Hierbei sind, z.B. für Wellenleiter, dünne Filme aus  $\text{Cu}_2\text{O}$  Gegenstand aktueller Forschung. In dieser Arbeit präsentieren wir die Herstellung von dünnen  $\text{Cu}_2\text{O}$  Filmen mit unterschiedlicher kristallographischer Orientierung auf  $\text{SrTiO}_3$ ,  $\text{Al}_2\text{O}_3$  und  $\text{MgO}$  Substraten. Mit der Methode der Laserablation ist es gelungen, dünne  $\text{Cu}_2\text{O}$  Filme mit unterschiedlicher kristallographischer Orientierung der Einheitszelle relativ zum Substrat herzustellen. XRD und TEM Analysen bestätigen ein verkipptes Wachstum von  $\text{Cu}_2\text{O}$  und sehr gute epitaktische Eigenschaften. Der Einfluss der Herstellungsparameter auf das Wachstum der Filme wird diskutiert.