DS 17: Poster: Trends in Ion Beam Technology, Magnetism in Thin Films, Functional Oxides, High-k Dielectric Materials, Semiconductor Nanophotonics, Nanoengineered Thin Films, Layer Deposition Processes, Layer Growth, Layer Properties, Thin Film Characterisation, Metal and Amorphous Layers, Application of Thin Films

Time: Tuesday 9:30–13:30 Location: Poster A

DS 17.1 Tue 9:30 Poster A

Assembly of the Göttingen Proton Microbeam — •Jonas Hartwig, Holger Schebela, Gerhard Faubel, Michael Uhrmacher, and Hans Hofsäss — II. Physikalisches Institut, Georg August Universität, Friedrich Hundt Platz 1 37075 Göttingen

A microbeam system was installed in the göttingen accelerator lab. The used ion beam source is a 3 MeV Pelletron accelerator. The system consists of a russian quadruplett lens system, two adjustable slits and a target chamber with a X-ray detector and two silicon particle detectors. Between object slit and lens system two pependicular capacitors are installed to scan the beam over the target. The data acquisition is performed by a MARCO MicroDas unit and MPSYS 4 as acquisition software. These components where formerly used in Freiburg by Prof. R. Brenn. The distance between object slit and lens system is about 8m and the distance between the lenses and the target is 40cm. With this geometrical setup the object should be demagnified by factor 20 if all interferring fields will be eliminated. We aim for a beam size of 1 micrometer. The system will be used for analytical purposes (especially microPIXE) and protonbeam writing. First test results will be presented.

DS 17.2 Tue 9:30 Poster A

Relaxation effects in NiMnSb-Half-Heusler thin films — •A. Stahl[1], C. Kumpf[1], and E. Umbach[1,2] — [1]Universität Würzburg, Experimentelle Physik II, 97074 Würzburg — [2]Forschungszentrum Karlsruhe, 76021 Karlsruhe

The Half-Heusler alloy NiMnSb is an important material which will possibly enable the fabrication of spintronic devices due to it's unusual half-metallic properties. It can be grown in high crystalline quality on InGaAs/InP substrates, however, as for all heteroepitaxial systems mechanical stress is an important factor which influences crystalline quality, film growth, and magnetic properties.

We present several series of x-ray measurements on MBE-grown NiMnSb thin films on InP(111) and InP(001) substrates. Reciprocal space mapping and x-ray reflectivity were measured using the six-circle-diffractometer at BW2, HASYLAB, Hamburg. Structural properties like the critical thickness for pseudomorphic growth, relaxation, and interface roughnesses are discussed. Caused by different substrate orientations the systems show differences in relaxation. Furthermore the influence of exposure to air was investigated by capping some of the samples.

DS 17.3 Tue 9:30 Poster A

Electron Microscopic Examinations of Nickel Silicides — Meiken Falke[1], •Thomas Schaarschmidt[1], Maureen MacKenzie[2], Gunter Beddies[1], Steffen Schulze[1], and Michael Hietschold[1] — [1]TU Chemnitz, Deutschland — [2]University of Glasgow, UK

NiSi is a promising material for electrical contacts and interconnections in the latest generation of CMOS devices [1]. However there is a lack of information especially about chemical or structural variations in nanometer scale compounds. Due to the progressing miniaturisation knowledge of such variations is crucial for the successful adoption of these materials. Another important aspect is the thermal stability of the low-resistivity NiSi phase which generally changes into NiSi2 at a temperature of 700°C. This phase transformation can be shifted towards higher temperatures by alloying with Pt [2]. Ni films on a Si(001) substrate were sputtered together with Pt under different conditions to achieve various Pt concentrations and subsequently heated at selected temperatures. The resulting Ni-Pt-Si layers were investigated by electron microscopy. EDX and EELS measurements were applied to study the elemental composition within the layers. A recent work [3] has shown that it is possible to distinguish between different pure nickel silicide phases because of a shift of the Ni-L2,3 edge in EELS spectra. A similar edge shift could be observed for the different Ni-Pt-Si phases at hand.

[1] Lavoie, C., et al., Microelectronic Engineering, 2003 [2] Mangelinck, D., et al., Applied Physics Letters, 1999 [3] Cheynet, M.C., Pantel, R., Micron, 2006 Acknowledgement: DAAD D/07/09995

DS 17.4 Tue 9:30 Poster A

Investigation of the system C_{60}/ITO by X-ray absorption and resonant X-ray emission spectroscopy — •Karl Heinz Hallmeier[1], Daniel Wett[1], Reinhard Denecke[1], Iver Lauermann[2], Konstantinos Fostiropoulos[2], and Boyan Johnev[2] — [1]Wilhelm-Ostwald-Institut, Universität Leipzig, Linnéstr. 2, D-04103 Leipzig — [2]Hahn-Meitner-Institut Berlin GmbH, Dep. SE 2, Glienicker Str. 100, D-14109 Berlin

The system C_{60}/ITO is currently used to develop organic solar cells. In order to characterize this system, X-ray absorption spectroscopy in the total electron yield mode (TEY) and resonant X-ray emission spectroscopy (XES) in dependence of the polarization of the incoming beam have been performed at BESSY II (beamline U41-PGM) using the spectroscopic apparatus ROSA. In the present study we investigated layers of 50 nm C_{60} on ITO substrates, deposited by vacuum thermal evaporation of commercially available powders from graphite crucibles. While all our resonant (and non-resonant) XES data are identical to the spectra for free C_{60} powder [1] and also the first four absorption lines in the TEY spectrum agree, distinct differences appear in the high-energy (continuum) region. Possible explanations are electronic interactions resulting in a dipole between the uppermost ITO atoms (preferentially oxygen) and carbon atoms from a C_{60} molecule, or structural effects resulting from (multiple) backscattering of electrons excited from the carbon 1s level by the uppermost atoms of the ITO substrate. Financial support by DFG (FG 404-SZ58/15).
[1] J. Guo, J. Nordgren, J. Electr. Spectr. Rel. Phen., 110 (2000) 105.

DS 17.5 Tue 9:30 Poster A

Zur Bildung von Ni-Hydriden in reaktiven Plasmen — •Marion Quaas[1], Harm Wulff[1], Oxana Ivanova[2] und Christiane A. Helm[2] — [1]Institut für Biochemie, Universität Greifswald, Felix-Hausdorff-Straße 4, 17487 Greifswald — [2]Institut für Physik, Universität Greifswald, Felix-Hausdorff-Staße 6, 17487 Greifswald

20 nm dicke Ni-Filme mit einer mittleren Domänengröße von 7 nm werden in einem Mikrowellen-Plasma (SLAN, 700W) in einem Gasgemisch von 10 sccm Ar/ 10 sccm H_2 mit verschiedenen negativen Substratvorspannungen behandelt. Die Bildung fester kristalliner Ni-Hydride und die kinetischen Prozesse bei der Plasma-Wand-Wechselwirkung werden durch die Kombination von Röntgendiffraktometrie im streifenden Einfall (GIXD), Röntgenreflektometrie (XR) und Atomkraftmikroskopie (AFM) untersucht.

In Abhängigkeit vom Ionenenergieeinstrom entstehen verschiedene Reaktionsprodukte. Ohne Substratvorspannung entsteht kein Ni-Hydrid. Lediglich partielles Verdampfen/Sputtern und ein Kristallwachstum kleiner Ni-Domänen werden beobachtet. Bis -25 V bildet sich Ni_2H, bei -50 V wandelt sich das Ni_2H zu NiH um, bei -75 V entsteht direkt NiH.

Die Ni_2H-Bildung erfolgt schnell, der Wachstumsprozeß der NiH-Phase wird durch die Vorspannung beeinflusst.

Die kinetischen Prozesse werden quantifiziert und diskutiert.

DS 17.6 Tue 9:30 Poster A

Quantification of Impurities in ZnO — Niklas Volbers[1], •Andreas Laufer[1], Bruno K. Meyer[1], and Kay Potzger[2] — [1]1. Physics Institute, Justus-Liebig University Giessen, Heinrich-Buff-Ring 16, D-35392 Giessen, Germany — [2]Institute for Ion Beam Physics and Materials Research, Forschungszentrum Dresden-Rossendorf, PO Box 51 01 19, D-01314 Dresden, Germany

Current research on zinc oxide (ZnO) focuses on bipolar doping. The severe difficulties in obtaining p-type ZnO have been partially attributed to intrinsic defects and impurities that act as compensating donors. To avoid these effects, it is therefore necessary to identify the impurities in the material. Among the methods for impurity analysis, secondary ion mass spectrometry (SIMS) is very attractive due to the fact that the chemical identity of the elements can be determined directly, independent of factors such as the ionisation state or binding type. In addition, the sensitivities are very high enabling one to de-

tect some elements in concentrations of as little as a few ppm. The quantification of SIMS data is possible using the method of relative sensitivity factors (RSF). Unfortunately, these factors vary for each host crystal and while there are RSF tables for Si and for compound semiconductors such as GaAs, InP or GaN, such a reference did not yet exist for ZnO. In the presented work, the RSF for a number of technological important elements have been determined, thus allowing one to quantify the impurity concentrations found. These factors have then been applied to ZnO crystals and thin films.

DS 17.7 Tue 9:30 Poster A

X-ray absorption spectroscopy of Prussian Blue analogues thin films — •Sébastien Bonhommeau, Niko Pontius, Hermann A. Dürr, and Wolfgang Eberhardt — Berliner Elektronenspeicherring-Gesellshaft für Synchrotronstrahlung m.b.H (BESSY), Albert-Einstein-Straße 15, 12489 Berlin, Germany

Prussian Blue (PB) was described for the first time in 1704. Since then, spectacular electrochemical, magnetic and photomagnetic properties have been revealed in PB and its analogues. In particular, CoFe PB analogues may display unusual photomagnetic effects arising from a light-induced Co(III)(low spin, S=0)-CN-Fe(II)(low spin, S=0) → Co(II)(high spin, S=3/2)-CN-Fe(III)(low spin, S=1/2) electron transfer accompanied by a spin change of Co. On the other hand, MnFe PB analogues exhibit transitions between the cubic Fe(III)(low spin, S=1/2)-CN-Mn(II)(high spin, S=5/2) phase and the tetragonal Fe(II)(low spin, S=0)-CN-Mn(III)(high spin, S=2) phase due to a charge-transfer-induced Jahn-Teller distortion.

We present X-ray absorption measurements performed at BESSY on RbCoFe, NaCoFe and RbMnFe PB 200 nm-thin films deposited on top of silicon nitride membranes. The experimental spectra are analysed using simulations based on the multiplet theory to estimate the properties of these films (crystal field, charge transfer, etc) compared to powder samples as well as the number of photoexcited CoFe and MnFe pairs.

DS 17.8 Tue 9:30 Poster A

The QQDS magnetic spectrometer "Little John" for High Resolution Depth Profiling — •Marcel Kosmata, Rainer Grötzschel, Daniel Hanf, Chavkat Akhmadaliev, Axel Weise, and Maik Vieluf — Forschungszentrum Dresden-Rossendorf e. V.

The aim of the modified magnetic spectrometer *Little John* [Gil89] is to measure concentration profiles of light elements in thin layers with sub-nanometer depth resolution by Elastic Recoil Detection Analysis (ERDA). For these measurements heavy ions from the Rossendorf 5MV-Tandem accelerator are directed to the sample. The ejected recoil atoms are detected and energy analysed under forward angles. The depth resolution depends directly on the energy resolution of the spectrometer. High energy resolution can only be obtained using magnetic particle spectrometers, where the energy measurement is transformed in a position measurement at the focal plane. The depth scale is provided by the stopping power of energetic heavy ions moving in matter, the available data of which assume a dynamic charge state equilibrium due to electron loss and capture along the ion trajectory. In the case of ultrathin layers the path length of the particles are too short to achieve this equilibrium. Since magnetic spectrometers separate particles with identical energy but different charge states it is necessary to consider charge state dependent stopping cross sections for quantitative data analysis. Here only very few data are available in the literature. In this work we introduce an experimental setup at *Little John* for charge state distribution measurements of light heavy ions and present first results.

DS 17.9 Tue 9:30 Poster A

Characterization and elemental analysis of nano- and microdimensional structures using PIXE and RBS — •Christoph Meinecke, Matthias Brandt, Marius Grundmann, Jürgen Vogt, and Tilman Butz — Institute of Experimental Physics II, University Leipzig, Linnestr. 5, 04103 Leipzig

Due to the current research in materials science, like in semiconductor physics, the production of micro- and nanostructures raises more interest for basic researchers. The aim is to control the electronic, magnetic and optical properties by variation of the elemental composition and feature size. During the last few years we developed an elemental characterization of different micro- and nanostructures using ion beam analysis with an expected spatial resolution of 100 nm, which is unique in the world.

New analytical experiments using focused high energy ion beams can reveal, apart from to stoichiometry and morphology, also the lattice structure of the micro- and nanostructures. The application of ion channeling like channeling-RBS and channeling-STIM to these new nanostructures, reveals lattice distortions.

This project characterizes sub-micrometer structures of different shapes and compositions (heterostructures, coated structures, homogeneous doped structures etc.) to learn more about growth procedures, electronic and magnetic properties, elemental distributions of multilayered microstructures and crystal quality using focused high energy ions.

DS 17.10 Tue 9:30 Poster A

Spray Pyrolysis as a deposition method for metal-oxide-particles — •Alexandre Santos Abreu[1], Christian Berthold[1], Matthias Knoll[1,2], Armin Konrad[2], Reinhard Tidecks[1], and Siegfried Horn[1] — [1]Universität Augsburg, Institut für Physik, EP II, Universitätsstr. 1, D-86159 Augsburg — [2]OSRAM GmbH, FL/CFL D-A, Berliner Allee 65, D-86135 Augsburg

Ultrasonic Spray Pyrolysis is a very promising method to produce metal-oxide coatings and particles, respectively, on an industrial scale. Since the Spray Pyrolysis coating process is determined by a large variety of parameters it has the potential to tailor coatings with differ-ent desired properties. For applications a sufficient adhesion as well as an adequate thermal and mechanical stability is required. Here, we demonstrate that the Ultrasonic Spray Pyrolysis is suitable not only to coat planar substrates but also to coat tubular glass substrates.

Using Spray Pyrolysis, yttria was deposited on both, planar and tubular, substrates. A pre-cursor solution containing yttrium nitrate was disposed using an ultrasonic nebulizer. The nebulised droplets subsequently were transferred into a tubular furnace by means of a carrier gas. Additionally particles which were not deposited on the substrate were collected in a glass-fibre filter at the outlet of the furnace. Experiments using different parameter settings were conducted. The as prepared coatings and particles were characterised by SEM and XRD. It is shown how the morphology and chemical composition is controlled by different settings of the processing parameters of the Spray Pyrolysis.

DS 17.11 Tue 9:30 Poster A

Investigation of Metal-Oxide Diffusion Barriers in fluorescent lamps using XPS Depth Profiling — •Christian Berthold[1], Alexandre Santos Abreu[1], Matthias Knoll[1,2], Armin Konrad[2], Reinhard Tidecks[1], and Siegfried Horn[1] — [1]Universität Augsburg, Institut für Physik, EP II, Universitätsstr. 1, D-86159 Augsburg — [2]OSRAM GmbH, FL/CFL D-A, Berliner Allee 65, D-86135 Augsburg

Mercury reduction in fluorescent lamps has become an important environmental issue recently. The goal is to increase the lamps lifetime and at the same time to reduce the amount of mercury dosed into the lamp. To this end, different metal-oxide coatings used as a diffusion barrier for mercury were examined using photoelectron spectroscopy (XPS). The purpose of the investigations was to establish a mercury depth profile within the diffusion barrier.

By layer-to-layer sputtering the surface sensitivity of XPS allows to determine the amount of mercury relative to an element within the diffusion barrier. From the depth profile the effectiveness of various diffusion barriers was determined. The experimentally obtained depth profiles of the mercury concentration within the coating can be described by Fick's laws with an infinite mercury reservoir as boundary condition. We will present the sample preparation as well as different diffusion profiles gained from miscellaneous metal-oxide layers.

DS 17.12 Tue 9:30 Poster A

High-Resolution Depth Profiling of thin high-k layers by means of HRBS — •Maik Vieluf[1,2], Rainer Grötzschel[1], Christian Neelmeijer[1], Marcel Kosmata[1], and Steffen Teichert[2] — [1]Forschungszentrum Dresden-Rossendorf, Deutschland — [2]Qimonda Dresden, Deutschland

The increasing interest in new high-k materials in MOS technology enforces the development of new analytical techniques to characterize the depth dependent elemental composition in ultrathin layers of such materials. The well established methods of ion beam materials analysis as Rutherford Backscattering Spectrometry (RBS) and Elastic Recoil Spectrometry (ERDA) can also provide depth profiles of elements and isotopes with subnanometer depth resolution. These techniques base upon the binary elastic nuclear scattering with well known cross sections and are therefore absolutely quantitative and standard-free. The

high energy resolution necessary for high depth resolution is achieved using magnetic spectrometers. We have installed a magnetic spectrometer of the Browne-Buechner-type at the 3 MV Tandetron accelerator of the FZD, which can provide a wide variety of MeV ions both for RBS and for ERDA. To minimise deterioration of the layers due to electronic sputtering during the measurements we implemented a multi-pad position sensitive detector (PSD) in the experimental setup to increase the solid angle and reduce the measurement time. This type of detector gives also the information needed for kinematical corrections. In this poster we describe the high-resolution spectrometer with the improved detector system and show the recent results.

DS 17.13 Tue 9:30 Poster A

Chemical composition of annealed Fe/$SrTiO_3$(001) and FeO/$SrTiO_3$(001) interfaces — •Alexander Demund, Benjamin Heinrich, Rüdiger Szargan, and Reinhard Denecke — Wilhelm-Ostwald-Institut für Physikalische und Theoretische Chemie, Universität Leipzig, Linnéstrasse 2, 04103 Leipzig

Physical interface properties, such as electron and ion conductivity, are strongly tied to the chemical composition of the interfaces. In order to understand processes during deposition or annealing, such as displacement and chemical reactions of atoms in the vicinity of the interface, we have chosen to investigate Fe/$SrTiO_3$(001) and FeO/$SrTiO_3$(001) interfaces by means of chemical state sensitive X-ray photoelectron spectroscopy.

During deposition of Fe in ultra high vacuum at room temperature oxidation of iron and reduction of titanium occurred. Annealing of iron and iron(II) oxide on $SrTiO_3$ caused an inversion of the reaction tendency observed during deposition: iron oxide was in general reduced, while reduced titanium was oxidized. As annealing of $SrTiO_3$ leads to an increasing number of defects, such as oxygen vacancies or Ti(III)-oxygen complexes, we used two differently pre-annealed $SrTiO_3$ crystals (600°C and 800°C). Thermally activated interface reactions occurred at lower temperatures for the crystal pre-annealed at 800°C. On this sample, the number of additional crystal defects detected during annealing was particularly elevated. The increased ion conductivity may play a decisive role in the reactivity of the interfaces.

Work has been supported by DFG (FG 404 Sz58/15).

DS 17.14 Tue 9:30 Poster A

Optical and structural analyses of evaporated thin films of Ga_2Se_3 and In_2Se_3 for solar cells — •Raik Hesse, Raquel Caballero, Daniel Abou-Ras, Christian A. Kaufmann, Thomas Unold, and Hans-Werner Schock — Hahn-Meitner-Institut, Glienicker Str. 100, 14109 Berlin

Ga_2Se_3 and In2Se_3 are used as precursor layers for Cu(In,Ga)Se_2 thin films, which are applied as solar absorbers for photovoltaics. These precursor layers were deposited at various substrate temperatures ranging from 250°C to 450°C on pure glass substrates and on Mo-coated glass substrates. The composition and thickness of the Ga_2Se_3 and In2Se_3 layers can be controlled in-situ by laser (LLS) and white light scattering (WLS). Controlling these parameters is essential since they affect the electrical properties of the Cu(In,Ga)Se_2 layer and therefore the performance of the solar cell. The samples were analysed by optical transmission and reflection measurements in order to determine refractive indexes and band-gap energies complementary to the LLS and WLS results. Ga_2Se_3 and In_2Se_3 were also studied by means of X-ray diffraction (XRD), scanning and transmission electron microscopy, energy dispersive x-ray spectroscopy and grazing-incidence XRD in order to identify different phases and interdiffusion. The formation of a $(Ga,In)_2Se_3$ solid solution was detected and analysed.

DS 17.15 Tue 9:30 Poster A

Microstructure and texture of Nb/$SmCo_5$ bilayers — •Rolf Schaarschuch[1], Silvia Haindl[2], Marianne Reibold[1], Volker Neu[2], Bernhard Holzapfel[2], Carl-Georg Oertel[1], Ludwig Schultz[2], and Werner Skrotzki[1] — [1]Institute of Structural Physics, Dresden University of Technology, D-01062 Dresden, Germany — [2]Institute for Metallic Materials, IFW Dresden, P.O. Box 270116, D-01171 Dresden, Germany

Since the possibility of "magnetic pinning"of vortices was reported many attempts were made to join the obvious antagonistic couple in the form of multilayers with a certain superconductor/ferromagnet sequence. Magnetic pinning describes the interaction between vortices of a superconductor with domain walls of a ferromagnet situated directly above or below the superconductor. Thin film architectures of $SmCo_5$ on Nb and the reversed system both, with and without Cr-spacer layer between superconductor and ferromagnet, were fabricated by pulsed laser deposition. The microstructures and textures/epitaxial relationships of the grown films were characterized by TEM and X-ray diffraction, respectively. As a result, for the layer system Nb/$SmCo_5$ the epitaxial relationship MgO(001)[100]//Cr(001)[110]//Nb(001)[110]//Cr(001)[110]//$SmCo_5$(11-20)[0001]//Cr(001)[110] were found. With decreasing thickness of the Cr-spacer layer the $SmCo_5$ texture becomes random. In contrast, for the system $SmCo_5$/Nb with decreasing thickness of the Cr-spacer layer the Nb texture changes from the component given above to a ¡110¿fibre. The findings are discussed with regard to lattice matching.

DS 17.16 Tue 9:30 Poster A

X-ray Absorption Spectroscopy on La0.7Ce0.3MnO3 films: a critical view on valencies — •Christoph Raisch[1], Mathias Nagel[1], Heiko Peisert[1], Thomas Chassé[1], Robert Werner[2], Dieter Koelle[2], and Reinhold Kleiner[2] — [1]Universität Tübingen, Institut für Physikalische Chemie — [2]Universität Tübingen, Physikalisches Institut - Experimentalphysik II, 72076 Tübingen, Germany

Strongly correlated electrons, lattice distortions and ordering phenomena lead to a highly interesting interplay between spin, charge and orbital degrees of freedom in the doped perovskite manganites $R_{1-x}A_xMnO_3$. Here we report on temperature-dependent XAS and PES measurements on $La_{0.7}Ce_{0.3}MnO_3$ films with varying oxygen content grown by PLD on $SrTiO_3$. The measurements were in part performed at the soft x-ray beamline WERA at ANKA in surface sensitive total electron yield (TEY) and bulk sensitive fluorescence yield (FY) mode. We studied the O K, the Mn $L_{2,3}$ and the Ce $M_{4,5}$ edges, both above and below T_C. Significant differences were found between TEY and FY modes even after thorough self-absorption correction. While the surface signal consists solely of tetravalent cerium and a mixture of di- and trivalent manganese, the fluorescence yield measurements show quite some amount of Ce^{3+} and only minor amounts of the Mn^{2+} species. The valency of manganese is directly related to the kind of doping, electrons or holes, and thus the properties of the sample. The films were further examined with PES of the valence band region and the manganese states. The results are discussed with regard to valency and oxygen content.

DS 17.17 Tue 9:30 Poster A

FT-IR Analyis of supercritical $Si_{1-x}C_x$ alloys — •Ina Ostermay[1], Thorsten Kammler[2], and Torsten Fahr[2] — [1]Fraunhofer Center Nanoelectronic Technologies, Königsbrücker Str. 180, D-01099 Dresden — [2]AMD Saxony LLC & Co. KG, Wilschdorfer Landstraße 101, D-01109 Dresden

Channel strain engineering by the use of lattice-mismatched Source and Drain stressors is widely investigated to improve the carrier mobility in CMOS Technology. In order to increase the performance of N-channel Transistors, embedded layers of Silicon Carbon can be used. Most challenging is the requirement that Carbon atoms need to be present on thermodynamic unstable lattice sites in order to create strain. Since the lattice mismatch at the crystal interface is responsible for the strain generation, the Carbon content needs to exceed the solid solubility limit by several orders of magnitude. For this study, $Si_{1-x}C_x$ layers up to 4,6 % Carbon were grown by Solid Phase Epitaxy (SPE) or Ultra High Vacuum Chemical Vapor Deposition (UHV-CVD) and characterized using SIMS, XRD and Fourier transformation infrared spectroscopy (FT-IR). Carbon was found not to be 100 % incorporated on lattice sites. FTIR was utilized to characterize the phase composition of those metastable layers whereas characteristic vibration modes were observed. These absorption bands could be correlated to the presence of substitutional carbon, coherent precipitates and incoherent 3C-SiC precipitates, respectively. It was found that $Si_{1-x}C_x$ layers created by SPE form incoherent precipitates while epitaxial grown $Si_{1-x}C_x$ alloys tend to form coherent ones.

DS 17.18 Tue 9:30 Poster A

Hard X-ray Photoemission Investigations on Multilayer Coatings for X-ray Optical Devices — •Mihaela Gorgoi[1], Franz Schäfers[1], Christine Borel[2], and Walter Braun[1] — [1]BESSY GmbH, Berlin, Germany — [2]ESRF, Grenoble, France

Many important properties of thin films are determined by the unique features of the interface atoms. A non-destructive way of accessing the electronic properties of buried interfaces is employing high kinetic energy photoelectron spectroscopy (HIKE). State-of-the art Mo/Si multilayers to be used for EUV-lithography and polarisation analysis were

investigated by means of HIKE. The measurements were performed at BESSY at the KMC-1 beamline employing the HIKE end-station. A specific example refers to the Mo/Si sample that has a multilayer repetition spacing of d=2.52 nm. To modify the interfacial quality of the multilayers, the samples were heated to a preset temperature, and then subsequently cooled to room temperature, at which time the spectra were taken. The recorded data for 2010 eV excitation energy show different energy shifts occurring in the energy position of the Mo 3d and Si 1s, 2p core levels. Similar behaviour is found at a different probing depth given by 6 keV excitation energy. These results will be correlated with ex-situ x-ray reflectivity measurements performed on the sample before and after the annealing process. A correspondence between the structural changes occurring in the sample and the quality of the interfaces reflected in the electronic properties is pursued.

DS 17.19 Tue 9:30 Poster A

Si nanocrystals in amorphous silica: atomistic models of the interface — •Flyura Djurabekova and Kai Nordlund — University of Helsinki

The poor optical properties of silicon due to its indirect bandgap have until now limited its application in optoelectronics. A novel nanocrystalline approach has disclosed a new prospect for silicon in this field. The observed superior light emitting properties (compared also to porous silicon) of silicon nanocrystals (Si-nc) embedded into amorphous silica (a-SiO_2) are associated with more stable Si/a-SiO_2 interfaces in the new structures. However, the mechanism of this phenomenon still remains unclear. The active role of Si-nanocrystal interface for the optical properties has been discussed intensively. In the present work, we report the creation of atomistic models of the interface by means of molecular dynamics atomistic simulations. Small Si-nc embedded into defect-free a-SiO_2 are constructed using two different classical interatomic potentials. After series of annealing runs, the interface structure and defects are carefully analyzed. The results show a thin suboxide layer along with mostly undercoordinated defects at the interface region.

DS 17.20 Tue 9:30 Poster A

Ion-beam assisted deposition of textured transition metal nitride films — •Martin Kidszun, Ruben Hühne, Konrad Güth, Bernhard Holzapfel, and Ludwig Schultz — IFW Dresden, Institute for Metallic Materials, P.O. Box 270116, D-01171 Dresden, Germany

Ion-beam assisted deposition (IBAD) offers the opportunity to prepare thin textured films on amorphous or non-textured substrates. It was shown within the last decade that thin cube textured layers of materials with a rocksalt structure like MgO or TiN can be produced on amorphous seed layers using this technique. In general, a reactive IBAD process using pulsed laser deposition of transition metals in combination with a nitrogen-containing ion beam was used for the preparation of different transition metal nitride layers. The results on the in-plane textured growth of TiN are promising for the development of conducting buffer layer architectures for YBCO coated conductors based on the IBAD approach. Recent results on the realisation of such an architecture using different substrates as Si/Si_3N_4 or polished Hastelloy tapes will be presented. Furthermore, this approach was used to prepare textured superconducting transition metal nitride thin films as for instance NbN. Detailed measurement of the structural and superconducting properties of such layers will be presented.

DS 17.21 Tue 9:30 Poster A

Low-energy ion beam smoothing of Si surfaces — •Frank Frost, Bashkim Ziberi, and Bernd Rauschenbach — Leibniz-Institut für Oberflächenmodifizierung e. V.

In addition to nanostructuring of various surfaces via self-organized pattern formation, low-energy ion beam erosion can be used as an alternative process for surface smoothing and the preparation of ultra-smooth surfaces. In this work, the surface smoothing of Si surfaces by Ar^+ ion beams (ion energy $\leq$ 2000 eV) was analyzed. Atomic force microscopy (AFM) has been used to systematically investigate the topography evolution of the surfaces with respect to different process parameters. The surface roughness was quantitatively characterized by the first order (rms roughness) and second order (power spectral density - PSD) statistical quantities. Based on the time evolution of these roughness parameters the relevant surface relaxation mechanisms responsible for surface smoothing have been discussed. Especially, it is shown that (i) smoothing can dominate for normal and near-normal ion incidence, (ii) if smoothing occurs, the minimum achievable surface roughness is limited by atomic noise, (iii) for low-energy Ar^+ ion beam erosion of Si surfaces ballistic drift (atomic transport parallel to surface) and ballistic diffusion are the dominant relaxation mechanisms, (iv) secondary sputter effects caused by backscattered projectile ions and sputtered Si atoms have a great impact on the topography evolution, and (v) smoothing by atomic ballistic drift is the most efficient smoothing process at short lateral length scales at normal and near normal ion incidence, respectively.

DS 17.22 Tue 9:30 Poster A

Carbon-Metal-Nanocomposites: Self-organization of multilayers during the co-deposition of energetic ions — •Hayo Zutz[1], Dominika Lyzwa[1], Inga Gerhards[1], Carsten Ronning[1], Michael Seibt[2], and Hans Hofsäss[1] — [1]II. Physikalisches Institut, Universität Göttingen, Friedich-Hund-Platz 1, 37077 Göttingen — [2]IV. Physikalisches Institut, Universität Göttingen, Friedich-Hund-Platz 1, 37077 Göttingen

Thin film growth of metal-carbon compounds by simultaneously low energy deposition of carbon and Fe, Au, Cu or Ni ions reveals a self-organization process resulting in alternating metal-rich and metal deficient layers with layer periods of about 10-20nm. The metal rich layer consists of crystalline clusters >5nm in diameter in an amorphous carbon matrix while the metal-deficient ones of a-C with homogenous distributed metal atoms or small clusters <2nm diameter. The self-organization process occurs only in a certain parameter regime for ion energies and C^+/metal$^+$ fluence ratios. By proper selection of the ratio it is possible to deposit metal-carbon nanocomposite films with homogenously distributed metal clusters (<2nm) in an a-C matrix . We investigated the metal-carbon nanocomposites for the simultaneous depositon of C^+ and Ni^+, Cu^+. The films were analyzed by Rutherford backscattering spectroscopy (RBS), energy dispersive X-ray (EDX) and cross-section transmission electron microscopy (TEM). The results are in agreement with a model for multilayer formation based on an interplay of sputtering, surface segregation, ion induced diffusion and the stability of small clusters against ion bombardment.

DS 17.23 Tue 9:30 Poster A

Formation and superconducting properties of $YBa_2Cu_3O_{7-x}$ / $Y_2Ba_4CuMO_y$ (M=Zr,Nb) quasi-multilayers prepared by off-axis PLD — •Elke Backen, Ruben Hühne, Ludwig Schultz, and Bernhard Holzapfel — IFW Dresden, P.O. Box 270116, 01171 Dresden, Germany

A significant enhancement of pinning forces in YBCO is possible by the introduction of nanosized transition metal particles (Ir, Ti, Hf, Zr) as artificial pinning centres using a quasi-multilayer deposition technique, i.e. the deposition of multilayers of subsequent complete YBCO and incomplete dopant layers. Another promising candidate for the use as artificial pinning centres in YBCO is $Y_2Ba_4CuMO_y$ (Y2411) (M=U, Nb, Ta, W, M, Zr, Ag). These second-phase, nanoscale inclusions have been successfully introduced into large, single-grain, bulk [Rare-Earth (RE)]-Ba-Cu-O superconductors where they form effective magnetic flux pinning sites over a wide range of external magnetic fields. A significant improvement of the J_c and the irreversibility field H_{irr} was observed in these samples. In this work we present first results on YBCO/Y2411 (M=Zr,Nb) quasi-multilayers prepared by off-axis pulsed laser deposition (PLD).

DS 17.24 Tue 9:30 Poster A

Microstructure and self-organization of nano-engineered artificial pinning centers in $YBa_2Cu_3O_{7-\delta}$ coated conductors — •Thomas Thersleff, Elke Backen, Sebastian Engel, Bernd Rellinghaus, Ludwig Schultz, and Bernhard Holzapfel — IFW Dresden, P.O. Box 270116, D-01171 Dresden, Germany

The fabrication of $YBa_2Cu_3O_{7-\delta}$ (YBCO) coated conductors capable of transporting large currents in high external magnetic fields is critical for their commercial implementation. The introduction of nanosized Artificial Pinning Centers (APCs) immobilizes flux lines at higher fields, thus increasing the usefulness and commercial applicability of coated conductors. Moreover, careful nano-engineering of these APCs facilitates the fine-tuning of the superconducting properties of coated conductors such as enhanced pinning along specific crystallographic orientations or an overall reduction in anisotropy. Understanding the self-organizational behavior of these APCs and their effect on the superconducting properties of YBCO thin films is the focus of this work. TEM lamellae from samples prepared on single crystal $SrTiO_3$ using both Pulsed Laser Deposition (PLD) and Chemical Solution Deposition (CSD) methods incorporating APCs were produced using a Carl

Zeiss 1540XB Focused Ion Beam (FIB) employing the in-situ lift-out method. TEM investigations on both a FEI Tecnai G^2 and Titan were carried out to elucidate the effect of the processing parameters on the organizational behavior of APCs and to subsequently correlate this to the macroscopic properties of these films.

DS 17.25 Tue 9:30 Poster A

Switchable electro-optical properties of polymer/metal nanocomposites containing chromophores — •Christian Hanisch[1], Christina Pakula[1], Claudia Bornholdt[2], Vladimir Zaporojtchenko[1], Rainer Herges[2], Thomas Strunskus[1], and Franz Faupel[1] — [1]Lehrstuhl für Materialverbunde, Institut für Materialwissenschaft, Technische Fakultät der CAU Kiel, Kaiserstraße 2, 24143 Kiel — [2]Otto Diels-Institut für Organische Chemie (Sektion Chemie), CAU Kiel, Otto-Hahn-Platz 4, 24118 Kiel

It is known that the combination of photoswitchable chromophores like azobenzole with different polymers can be achieved in various ways. Our aim is to use the photoinduced change in the chromophore conformation in combination with metal/polymer nanocomposites to develop light switchable resistors, optical filters, Bragg-reflectors, capacitors, or other devices. For the sample preparation we used thermal evaporation from up to three independent sources as well as spin-coating of polymers to produce the different sample morphologies needed. The sample morphology was characterized by TEM microscopy. First results with a focus on the tunable electrical resistances in quasi 2D- and 3D- sample geometries are presented.

DS 17.26 Tue 9:30 Poster A

Nano-hole filling with Iron oxides by Atomic Layer Deposition (ALD) — Christian Pfahler[1], •Marc Saitner[1], Alfred Plettl[1], Paul Ziemann[1], Johannes Bikupek[2], Jens Leschner[2], Ute Kaiser[2], Julien Bachmann[3], Yuen Tung Chong[3], and Kornelius Nielsch[3] — [1]Institut für Festkörperphysik, Universität Ulm, D-89069 Ulm, Germany — [2]Materialwissenschaftliche Elektronenmikroskopie, Universität Ulm, D-89069 Ulm, Germany — [3]Institut für Angewandte Physik, Universität Hamburg, D-20355 Hamburg, Germany

Well-ordered periodic nanomasks are generated by a micellar technique [1] and are subsequently used for the preparation of ordered arrays of nanopores. For this purpose a CF_4/CHF_3-gas mixture is applied for etching of Si [2]. The order of the masks is transferred to arrays of pores with diameters between 20 and 30 nm and aspect ratios up to about 10.

After cleaning the substrates by heating in vacuum, the holes are filled with Fe_2O_3 by ALD at 200 °C using ferrocene and ozone as precursors. The Fe_2O_3 filling can be reduced to Fe_3O_4 for further magnetic studies.

The samples are mainly characterized by high resolution scanning (HRSEM) and high resolution transmission electron microscopy (HRTEM) revealing the three dimensional structure.

[1] G. Kästle et al., Adv. Funct. Mat. 13, 853 (2003).
[2] S. Brieger et al., Nanotechnology 17, 4991 (2006).

DS 17.27 Tue 9:30 Poster A

Eigenschaften von Sol-Gel-Aluminiumoxidschichten mit inkorporierten Wolframdisulfid-Nanopartikeln — •Hilke Hattermann, Michael Griepentrog, Marko Szuggars und Thomas Hübert — Bundesanstalt für Materialforschung und -prüfung (BAM), Berlin, Deutschland

Dünne Schichten aus Aluminiumoxid finden bereits seit geraumer Zeit als Verschleißschutzschichten Verwendung, beispielsweise auf Werkzeugen. Durch die Inkorporation von Schmierstoff-Nanopartikeln wie Wolframdisulfid in Form von anorganischen Fullerenen in die Aluminiumoxidschicht wird nun zusätzlich eine Verbesserung des tribologischen Verhaltens erwartet, insbesondere eine Reduktion der Reibung. Das Einbringen der Nanopartikel und die Schichtherstellung erfolgen mit Hilfe eines Sol-Gel-Verfahrens. Die mechanischen Eigenschaften der resultierenden Nanokompositschicht wie Härte und E-Modul, die mit Nanoindentation gemessen werden können, sowie Haftfestigkeit und Rauheit sollten dabei gegenüber einer undotierten Schicht möglichst wenig verändert sein.

Diese Untersuchung findet im Rahmen des EU-Projektes FOREMOST statt.

DS 17.28 Tue 9:30 Poster A

Controlling the formation of Nanoparticles for definite growth of Carbon Nanotubes — •Sascha Hermann, Stefan Schulz, and Thomas Gessner — TU Chemnitz, Center for Microtechnologies, Reichenhainer Strasse 70, 09126 Chemnitz, GERMANY

Our interest is the integration of carbon nanotubes (CNT) in electronic devices (IC, NEMS). This carbon material has some outstanding properties making it a promising candidate fulfilling future requirements for integrated circuit devices (ITRS). Among others we try to replace in a first step the vertical Cu- interconnect with CNT-wires. The requirements for this aim are very challenging as one has to achieve high density aligned CNT-growth with high conductivity at low temperature consistent with microelectronic processes lines (<450°C). In the scope of this work we present a study on the preparation of the catalyst Ni-particles from ultrathin films and the synthesis of carbon nanotubes by the chemical vapour deposition method. For the preparation we use a cold wall CVD-reactor especially designed for handling samples up to a size of a 4 inch wafer. We show the influence of temperature and substrate material on particle formation focusing on optimization of size distribution and density. Furthermore, we present MWNTs grown at temperatures even as low as 500°C. The nanotubes were characterized by scanning electron microscopy, transmission electron microscopy, and Raman spectroscopy.

DS 17.29 Tue 9:30 Poster A

Strong Er luminescence at 1533 nm in rapid thermal annealed Si-rich SiO_2 layers co-implanted with Er — •Aloke Kanjilal, Lars Rebohle, Matthias Voelskow, Wolfgang Skorupa, and Manfred Helm — Institute of Ion Beam Physics and Materials Research, Forschungszentrum Rossendorf, PO Box 51 01 19, 01314 Dresden, Germany

The Er-doped SiO_2 layers containing Si nanocrystals (Si-ncs) have attracted considerable interest for a decade in realizing efficient light sources at about 1540 nm, which coincides with the telecommunication wavelength. Although about two orders of magnitude Er luminescence has been noticed in long time annealed sputtered deposited samples, observation of such high efficiency in ion implantation processed samples is scarce in literature. Recently, we have succeeded in producing such a system by a combination of sequential Si and Er implantations and rapid thermal annealing. The processing conditions have been optimized for achieving maximum Er photoluminescence (PL) at 1533 nm at the expense of the Si-nc related PL band peaking at 870 nm according to the quantum confinement (QC) model, taking the advantage of the visible-range pumping of Er ions by Si-ncs. Spectral analyses suggest that the appearance of a broad PL band at 870 nm can be explained in the light of the interfacial state mediated recombination of carriers in the Si-ncs according to the QC model. The energy migration from Si-ncs to the nearby Er ions has further been manifested using time-resolved PL measurements.

DS 17.30 Tue 9:30 Poster A

Nanostrukturierte Goldfilme als breitbandige Terahertz-Antireflexschicht — •Andreas Thoman, Andreas Kern, Hansper Helm und Markus Walther — Freiburger Materialforschungszentrum, Stefan-Meier-Straße 21, 79104 Freiburg

Mit Hilfe der Terahertz Time-Domain Spektroskopie (THz-TDS) [1] wurden die Eigenschaften von nanostrukturierten Goldfilmen auf Silizium im Frequenzbereich von 200 GHz - 2 THz (7 - 66 cm^{-1}) untersucht. Wir zeigen sowohl experimentell als auch theoretisch, dass solche Goldfilme aufgrund ihrer Nanostruktur charakteristische dielektrische Eigenschaften aufweisen, welche es ermöglichen breitbandige Antireflexschichten im THz-Frequenzbereich herzustellen, deren Qualität die homogener Metallfilme [2] übertrifft. Bei optimal gewählter Schichtdicke und Leitfähigkeit des Goldfilms ist es aufgrund Oberflächenimpedanzanpassung möglich, die Reflexion des THz Pulses am Silizium-Gold-Luft Übergang zu unterdrücken. Dieses Verhalten kann mit Hilfe der Finite Difference Time-Domain Methode (FDTD) simuliert werden [3]. Kürzlich konnte gezeigt werden [4], dass die dielektrischen Eigenschaften solcher Filme durch ein modifiziertes Drude Modell (Drude-Smith) beschrieben werden können. Wir zeigen, dass gerade die Abweichung vom idealen Drude-Verhalten die Realisierung einer nahezu perfekten, breitbandigen Antireflexschicht ermöglicht.

[1] P. Uhd Jepsen, A. Thoman et al, Phys. Rev. B 74, 205103 (2006), [2] J. Kröll et al, Optics Express 15 (11), 6552 (2007), [3] A. Kern and M. Walther, J. Opt. Soc. Am. B, submitted, [4] M. Walther et al, Phys. Rev. B 76, 125408 (2007)

DS 17.31 Tue 9:30 Poster A

Sputter deposition of $CuS_{1-x}O_x$ thin films using ceramic targets — •Swen Graubner, Angelika Polity, Detlef Hofmann, and

Bruno K. Meyer — IPI Justus-Liebig-Universität Giessen

The efficiency of CuO solar cells can be estimated up to 30%, although the band gap of CuO is about 0.4 to 1.0eV too large compared to the ideal band gap of about 1.5eV. Substitution of oxygen by sulphur may lead to $CuS_{1-x}O_x$ compounds with reduced band gap and might thus have higher efficiencies. The sputter deposition offers several ways for the preparation of $CuS_{1-x}O_x$ thin films: the most common one is to use a metallic Cu target and reactive gases like H_2S and O_2. An alternative is the usage of a sintered (ceramic) Cu_2S target with O_2 as reactive sputtering gas. We concentrated on the later, which has the potential to provide higher sulphur concentrations in the films. The thin films were sputtered under various conditions of the substrate temperature and process pressure. To analyze the morphology, the films were investigated by x-ray diffraction (XRD) and electron microscopy. Secondary ion mass spectroscopy (SIMS) and energy dispersive x-rays (EDX) gave information about the stoichiometry of the layers. The band gap properties as a function of the sulphur content were determined by optical absorption measurements, and temperature dependent Hall-effect was measured to determine the carrier concentration and the mobility.

DS 17.32 Tue 9:30 Poster A

The influence of electric fields on the time-resolved luminescence of hybrid organic-inorganic structures — •Jędrzej Szmytkowski[1,3], Jonas Conradt[1], Peter Marek[2], Teodor Silviu Balaban[2,3], and Heinz Kalt[1,3] — [1]Universität Karlsruhe (TH), Institute of Applied Physics, Karlsruhe, Germany — [2]Karlsruhe Institute of Technology (KIT), Forschungszentrum Karlsruhe, Institute of Nanotechnology, Karlsruhe, Germany — [3]Center for Functional Nanostructures (CFN), Karlsruhe, Germany

The understanding of the process of electron transfer from an organic dye to inorganic material, like TiO_2 and ZnO, is crucial for the fabrication of efficient hybrid solar cells. Time resolved luminescence studies within applied external electric fields have been performed for several hybrid organic-inorganic structures. The decay associated spectra (DAS) have been used to analyze the dynamics of the luminescence decay. This method allows us to control the dissociation of excitons at the interface of organic-inorganic bilayers.

DS 17.33 Tue 9:30 Poster A

Thickness-dependency of electroreflectance spectra at titanium oxide films — •Andreas M. Zoll and Roger Thull — Lehrstuhl und Abteilung für Funktionswerkstoffe der Medizin und Zahnheilkunde, Universitätsklinikum Würzburg, Pleicherwall 2, D-97070 Würzburg

Thick titanium oxide films have not only attractive properties like good blood compatibility and good corrosion resistance making them very suitable for medical implants, but also very interesting electro optical properties investigated in this study.

The presented titanium oxide films are deposited using unfiltered arc sputtering technique on polycrystalline titanium surfaces. The film thickness is 50 - 200 nm depending ion the deposition time. Substrate temperature was kept at 300 °C.

While thin films of approx. 50 nm showed typical features of low-field electroreflectance spectra at transition energies, ER spectra of thicker films showed oscillations in the sub-gap region corresponding to the first derivative of conventional reflectance spectroscopy.

The band gap was determined using photocurrent spectroscopy and was found at 3.05 +/- 0.05 eV for all samples.

DS 17.34 Tue 9:30 Poster A

Subgridding in the FDTD method for simulating the interaction of terahertz radiation with metal — •Andreas Kern, Hanspeter Helm, and Markus Walther — Deptartment of molecular and optical physics, University of Freiburg

Simulating the interaction of electromagnetic terahertz radiation with metals poses difficulties not encountered in the optical regime. Due to a penetration depth small compared to the wavelength, such simulations in the terahertz frequency range require large discretisation volumes with very small grid spacings. To cope with these large scale differences, a novel subgridding scheme was developed that can be used to accurately describe the interaction of long-wavelength radiation with metals while keeping computational costs minimal. Bidirectional coupling between grids allows for the complete integration of refined subdomains into the simulation volume. Implementation in one and two dimensions is demonstrated, and a comparison with theoretical and experimental results is given. Using our technique, we are able to accurately simulate surface-plasmonic effects in terahertz experiments for the first time.

DS 17.35 Tue 9:30 Poster A

INFRARED ELLIPSOMETRY STUDY OF $LaNiO_3$/$LaAlO_3$ SUPERLATTICES — •Y. Matiks, A.V. Boris, P. Popovich, H.-J. Kim, G. Cristiani, H.-U. Habermeier, and B. Keimer — Max-Planck-Institut für Festkörperforschung, Heisenbergstr. 1, 70569 Stuttgart

The far-IR variable angle spectroscopic ellipsometry, as a power optical technique for the investigation of the dielectric properties of thin films, was used to study electrodynamics of $LaNiO_3$/$LaAlO_3$ superlattices. These superlattices with different individual layer thickness and number of interfaces were deposited on $SrTiO_3$, $LaSrGaO_4$, $LaSrAlO_4$ substrates by pulsed laser deposition.

We found that an increasing of substrate lattice parameter and a decreasing of individual layer thickness induce the decreasing of the charge carrier density. A decreasing of the thickness of layer to one unit cell leads to the insulator-metal transition in $(LaNiO_3)$n/$(LaAlO_3)$n superlattices on $SrTiO_3$ substrate. This metal-insulator transition may be induced by two factors: 1) localization of the electrons in the context of orbital reconstruction at the interfaces; 2) granulating of layers with the thickness close to one unit cell due to the roughness of substrates.

DS 17.36 Tue 9:30 Poster A

Charge transient spectroscopy (QTS) on organic semiconductors and thin films — •Markus Arnold, Axel Fechner, and Dietrich R.T. Zahn — Physics Department, Chemnitz University of Technology, D-09107 Chemnitz

Charge transient spectroscopy (QTS) is an electrical measurement method related to deep-level transient spectroscopy (DLTS) developed originally by Lang [1]. With DLTS it is possible to investigate charge carrier traps by monitoring capacitance transients. The capacitance is that of the space charge region of inorganic semiconductor or Schottky diodes. Therefore one can not measure samples negligible space charge region using DLTS as is the case for organic semiconductors. The increasing interest in organic semiconductors and organic thin films provides strong motivation for the scientists study the properties of organic devices in depth. With QTS it is possible to measure fast charge reloading processes in the samples as a function of time and the temperature with different pulse voltages and pulse widths. As a result one can determine the number of the traps of e.g. in organic field-effect transistors (OFETs).

[1] D. V. Lang; Deep-level transient spectroscopy: A new method to characterize traps in semiconductors; J. Appl. Phys. 45, 3023 (1974).

DS 17.37 Tue 9:30 Poster A

Kogesputterte Materialien - Einflüsse der Zusammensetzung auf verschiedene Eigenschaften unter Berücksichtigung optischer Funktionalität. — •Christina Polenzky — Fraunhofer-Institut für Schicht- und Oberflächentechnik (IST), Bienroder Weg 54e, 38108 Braunschweig, Deutschland

Ein komplexer Ansatz des optischen Filterdesigns beruht auf einem kontinuierlichen, sinusförmigen Brechzahlprofil, sogenannte Rugate-Filter. Die Vorteile dieses Filter-Typs gegenüber einem herkömmlichen HL-Filter liegen darin, dass es keine scharfen Grenzflächen innerhalb des Schichtsystems gibt, die das thermische und mechanische Verhalten eines optischen Filters stark begrenzen können. In der Praxis lässt sich ein kontinuierliches Brechzahlprofil gut realisieren, indem viele dünne Schichten mit geringen Brechungsindexunterschieden übereinander abgeschieden werden. Diese werden prozesstechnisch meist durch das Mischen zweier Einzelmaterialien in unterschiedlichen Anteilen realisiert. Für das Design des Rugate-Filters wurden bisher, soweit bekannt, nur die optischen Eigenschaften berücksichtigt. In der Anwendung stehen den Vorteilen des Rugates (Wegfall von Grenzflächen) höchste Anforderungen an die Schichtstapel hinsichtlich Haftung und Spannung, auch unter Temperaturbelastung, gegenüber. Beide Eigenschaften sind bei Rugates kritischer als bei konventionellen Filtern, da diese tendenziell aufgrund der geringen optischen Dichte dicker ausfallen.

DS 17.38 Tue 9:30 Poster A

Electromigration in Silver Nanowires — •Christian Wirtz, Niemma Buckanie, Frank-Joachim Meyer zu Heringdorf, and Günter Dumpich — Universität Duisburg-Essen , Fachbereich Physik, Lotharstrasse 1 , 47048 Duisburg

We observe electromigration in silver nanowires by in-situ scanning electron microscopy. Single-crystalline nanowires are prepared employing a self-organised growth process, polycrystalline wires by electron beam lithography (EBL). These nanowires are contacted by voltage and current leads, also using an EBL technique. Electromigration is then induced applying current densities in the range of 10^8 A/cm^2 in either two- or four-terminal mode. Under these conditions, the single-crystalline silver nanowires exhibit a direction of mass flow opposed to that found in their polycrystalline counterparts. This effect is currently believed to originate from surface diffusion effects and to be intimately related to the direct force exerted on the ion cores by the electric field. Further research efforts will comprise investigation of irradiated single-crystals and the role of disorder in electromigration processes. This work is supported by the DFG (SFB 616).

DS 17.39 Tue 9:30 Poster A

Threshold switching in as deposited phase change materials — •Christoph Classen, Michael Woda, and Matthias Wuttig — I. Physikalisches Institut (1A), RWTH Aachen, 52056 Aachen, Germany

The material class of so called phase change (pc) materials are alloys often containing Sb or Te. Pc materials show an astonishing set of properties as they possess large electrical and optical contrast upon the phase transition from the amorphous to the crystalline phase. On the other hand this reversible transition can be accomplished by either a laser or an electrical pulse on a ns time scale, which makes this material class very promising for memory applications such as PRAM (Phase change RAM).

The threshold switching process is an essential and mandatory feature for phase change material. It enables switching from the amorphous to the crystalline state at low applied voltages and hence is crucial for mobile applications. Presumably this effect is predominantly electronic in nature. In this study our experimental method of choice is presented to measure threshold switching from sputtered as deposited thin films without processing technologically demanding device structures. This approach is employed to investigate the stoichiometry dependence of threshold switching for a number of phase change alloys.

DS 17.40 Tue 9:30 Poster A

Growth of metallic layers on single crystal diamond investigated by infrared spectroscopy — •Sebastian Noebel, Robert Lovrincic, and Annemarie Pucci — Kirchhoff-Institut für Physik der Universität Heidelberg

Electronics based on single crystal diamond provide advantages in many applications, for instance as high energy particle detectors. For all applications the metallization is a decesive step. Besides other metals, chromium and aluminium are often used as electrode materials. Hence we investigate the growth of chromium and aluminium on diamond by means of infrared spectroscopy in order to derive information about the conductivity of the film in a non-contact way. Furthermore, the advantages of the two different metals regarding detector applications will be discussed.

DS 17.41 Tue 9:30 Poster A

Laser deposition of niobium as a refractory metal — •Christian Pansow, Markus Trautmann, Matthias Büenfeld, Veit Grosse, Frank Schmidl, and Paul Seidel — Institut für Festkörperphysik, Jena, Deutschland

Pulsed Laser Deposition (PLD) has become a powerful instrument to grow several types of thin film layers. For some high temperature applications it is essential to use metals with high melting points as conducting materials. In this work, we present the actual state of our studies on the PLD of niobium thin films grown on Si. We investigated the influence of different laser energies, substrate temperatures, argon pressures and energy densities to ensure a high film quality. Our ambition includes good conductivity, low surface roughness, film homogeneity and a low droplet density. We analysed our films with atomic force microscopy (AFM), x-ray diffraction (XRD), auger electron spectroskopy (AES) and scanning electron microscope (SEM).

DS 17.42 Tue 9:30 Poster A

Morphology of ion-beam eroded Si surface: Sputtering at near normal and glancing incident angles — •Kun Zhang[1], Hans Hofsäss[1], Frank Rotter[1], Klaus Jesiek[1], Michael Uhrmacher[1], Carsten Ronning[1], and Johann Krauser[2] — [1]II. Physikalisches Institut and SFB 602, Universität Göttingen, Friedrich-Hund-Platz 1, 37077 Göttingen, Germany — [2]Fachbereich Automatisierung und Informatik, Hochschule Harz, Friedrichstraße 57-59, D-38855 Wernigerode

Surface morphology evolution induced by ion-sputter-erosion can be explained by a linear continuum theory (developed by Bradley and Harper) of the interplay between ion beam erosion roughening and surface diffusion smoothening processes. This theory predicts the evolution of quasi-periodic surface ripple-patterns, which orientate perpendicular to the beam direction for tilted incidence angles less than a critical angle θ_c (but quite generally, greater than about 30°), or parallel to the beam direction for incidence angles close to grazing. In this work, we report on the evolution of Si surfaces investigated with incidence angles at two extreme cases: near sample normal direction and around the critical angle. The experiments were performed using atomic force microscopy after low-energy (2 – 5 keV) Xe^+ ion irradiation at room temperature with ion-fluences from $3 \cdot 10^{14}$ ions/cm^2 to $1 \cdot 10^{18}$ ions/cm^2. After erosion at near normal direction ($\theta < 30°$), the surfaces are flat and isotropic, in contract to other reports. Two-dimensional nano-patterns evolve after erosion at critical angle θ_c.

DS 17.43 Tue 9:30 Poster A

Modifizierung von Silizium-Oberflächen zur molekularen Erkennung von Peptiden und Proteinen — •Steffen Kröning[1], Karsten Hinrichs[2], Dana Rosu[2], Norbert Esser[2], Jörg Rappich[3] und Rudolf Volkmer[1] — [1]Abteilung Molekulare Bibliotheken, Institut für Medizinische Immunologie, Charité Universitätsmedizin Berlin, Hessische Str. 3-4, 10115 Berlin — [2]Abteilung Interface Spektroskopie, ISAS- Institute for Analytical Sciences, Albert-Einstein-Str. 9 12489 Berlin — [3]Abteilung Silizium-Photovoltaik, Hahn-Meitner-Institut Berlin GmbH, Kekuléstr. 5, 12489 Berlin

Die Untersuchung biologischer Substanzen (z.B. DNA, Proteine, Peptide) gewinnt immer mehr an Bedeutung und ist ein wachsender Bereich innovativer Entwicklungen. Diese Substanzen können durch Sekundärreaktionen (Schlüssel-Schloss-Prinzip) in minimalen Konzentrationen hochspezifisch nachgewiesen werden, wobei vorrangig im ersten Schritt die Bindung an Oberflächen wie Glas, Gold, Cellulose oder Plastik genutzt wird. Durch Kombination von Halbleitertechnik mit organischer Chemie können Oberflächen mit einzigartigen Eigenschaften erzeugt werden. Die Funktionalisierung der Si-Oberfläche mittels ultradünner organischer Schichten und Monolagen von Molekülen wird seit wenigen Jahren intensiver untersucht. Unser Forschungsansatz stellt die direkte Bindung von Linkermolekülen (z.B. Alkenderivate und organische Azidoverbindungen an Si-H terminierten Oberflächen dar. In der gerichteten Immobilisierung dieser Linkermoleküle an Oberfläche besteht die Möglichkeit Peptide und Proteine elektrochemisch mittels einfacher chronoamperometrischer Messungen in Echtzeit zu erkennen.

DS 17.44 Tue 9:30 Poster A

Influence of the process parameters on the photocatalytic activity of TiO_2 thin films deposited by metal plasma immersion ion implantation — •D. Manova[1], F. Haberkorn[1], A. Gjevori[1,2], J.W. Gerlach[1], W. Assmann[3], and S. Mändl[1] — [1]Leibniz-Institut für Oberflächenmodifizierung, Leipzig — [2]Faculty of Natural Sciences, University of Tirana, Tirana, Albania — [3]Ludwig-Maximilians-Universität München, Garching, Germany

Photocatalytic processes have been extensively studied due to their great potential for solvent and air purification and self cleaning. Recently, TiO_2 powder and especially its anatase polymorph attracted a lot of interest as one of the most effective photocatalysts. Metal plasma immersion ion implantation and deposition was employed to form TiO_2 thin films on Si and glass substrates by applying high voltage pulses up to 10 kV in a Ti-O plasma. XRD measurements were performed together with elastic recoil detection analysis (ERDA) to investigate the structure and to derive the stoichiometry, respectively. Additionally, scanning electron microscopy was carried out to investigate the surface morphology. Slightly substoichiometric films with a predominantly rutile structure were obtained. Subsequently, the deposited films were irradiated with UV light. A strong influence of the irradiation on the surface energy of the films, derived from the contact angle measurements, was found with increasing pulse voltage, with an additional influence of the substrate. However, no correlation between the anatase content and the changes in the surface energy was observed.

DS 17.45 Tue 9:30 Poster A

Structural evolution during direct pulsed laser interference patterning — •Stephen Riedel, Matthias Hagner, Paul Lei-

derer, and Johannes Boneberg — University of Konstanz, Departement of Physics, D-78457 Konstanz, Germany

Laser interference lithography with cw-lasers is widely used for the development of micro- and nanostructures on photoresists and subsequent transfer of the structures in the respective substrate. In contrast we present direct laser patterning with a single ns-pulse, where the substrate is structured by several interfering beams. For that purpose we use a frequency doubled Nd:YAG laser (FWHM = 10 ns) and intensities between 50 - 200 mJ. This allows obtaining structured areas of about $1mm^2$. We present the energy dependence of structures on different substrates (Au, Ta, Si ...) and show some time resolved measurements on the structuring dynamics. From these measurements a model for the process is developed which is based on Marangoni effects.

DS 17.46 Tue 9:30 Poster A

Pulsed laser deposited $La_{0.7}Ce_{0.3}MnO_3$ thin films: Dependence of properties on growth parameters — •Robert Werner, Victor Leca, Christoph Back, Reinhold Kleiner, and Dieter Koelle — Universität Tübingen, Physikalisches Institut – Experimentalphysik II, 72076 Tübingen, Germany

$La_{0.7}Ce_{0.3}MnO_3$ thin films were grown epitaxially by pulsed laser deposition on (001) $SrTiO_3$ substrates. The evolution of the growth front and the film thickness were monitored in-situ by means of high-pressure reflection high energy electron diffraction, while the morphology and crystal structure were analyzed by atomic force microscopy and X-ray diffraction, respectively. Furthermore, electrical transport and magnetic properties of the films were studied in the 5–300 K temperature range.
Single phase films could be obtained only for $p_{O_2} > 0.13$mbar. With increasing pressure, the roughness increased. A roughness of one unit cell could only be obtained at a pressure around 3Pa. The evolution of the electric transport and magnetic properties with the level of strain (film thickness) will be discussed. Depending on the deposition parameters we got a transition temperature between 220-260 Kelvin.

DS 17.47 Tue 9:30 Poster A

Magnetic properties and exchange bias effects in nanocluster assembled films of equiatomic Fe-X (X=Pd, Pt, and Au) synthesized by inert gas phase condensation — Chandrahas Bansal[1,2], •Ajay Kumar Mishra[1], and Horst Hahn[1] — [1]Institute for Nanotechnology, Forschungszentrum Karlsruhe, Karlsruhe 76021, Germany — [2]University of Hyderabad, Hyderabad 500 046, India

Nanocluster assembled films of equiatomic Fe-Pd, Fe-Pt, and Fe-Au alloys were synthesized using a UHV nanocluster film deposition system (model NANODEP60 from Oxford Applied Research, UK). The films were nanoporous and consisted of agglomerates of small size nanoclusters of diameters 4 to 5 nanometers. The M(T) data in zero-field-cooled (ZFC) and field-cooled (FC) states revealed a blocking temperature of 33 K, 35K, and 41K for the Fe-Pt, Fe-Pd, and Fe-Au cluster films. Besides this, there was a paramagnetic response at lower temperatures both in the ZFC and FC states showing that there was a partial oxidation of the clusters even in the as-prepared films although they were deposited at base pressures of 10-8 torr. The defect states in the oxide shell gave rise to these moments that remained uncoupled to the antiferromagnetic lattice. A exchange bias of about 1 KOe was observed in all the three alloys with the lowest value for Fe-Au and the highest value for Fe-Pd cluster films.

DS 17.48 Tue 9:30 Poster A

Soft Magnetic nanocomposite films for high frequency applications — •Amit Kulkarni[1], Henry Greve[1], Andreas Gerber[2], Ulrich Schürmann[2], Vladimir Zaporojtchenko[1], Eckhard Quandt[2], and Franz Faupel[1] — [1]Chair for Multicomponent Materials, Institute for Materials Science, Christian-Albrechts University at Kiel, Kaiserstr. 2, Kiel, Germany, 24143. — [2]Chair for Inorganic Functional Materials, Institute for Materials Science, Christian-Albrechts University at Kiel, Kaiserstr. 2, Kiel, Germany, 24143.

Advances in mobile communication have stimulated research on high frequency magnetic components. Nanocomposites with either a particulate or a multilayer nanostructure are promising candidates and could play an important role in such magnetic high frequency applications. Thin multilayer films of sputtered PTFE (Teflon) and $Fe_{54}Ni_{27}Co_{19}$ with different layer thicknesses were prepared by vapor-phase tandem deposition. These films are several hundred nanometers thick and consist of $Fe_{54}Ni_{27}Co_{19}$ as ferromagnetic and a fluoropolymer as the insulating material component. So far we were able to obtain cut-off frequencies up to 5 GHz and HF-permeabilities above 100 for the multilayer nanostructured films. In addition to a Teflon dielectric, FeCoV- TiO_2 / TiO_2 nanocomposite multilayer system were prepared with a very thin isolation layer of TiO_2. Both approaches proved to be promising as novel high frequency components up to the GHz range.

DS 17.49 Tue 9:30 Poster A

Reactive deposition of SnO2:Sb thin films utilizing HPPMS: Correlation between film properties and process parameters — •Janika Boltz, Dominik Köhl, and Matthias Wuttig — I. Physikalisches Institut (1A), RWTH Aachen, 52056 Aachen

In recent years high power pulsed magnetron sputtering (HPPMS) has gained growing interest due to its inherent advantages over conventional dcMS that mainly arise from the increased plasma density and thereby ionization of the sputtered material. It has been demonstrated e.g. for several metal targets that the large degree of ionization (up to 70%) in the sputtered species and the resulting low-energy bombardment of the substrate can promote the growth of films with increased density and low surface roughness. But only recently the new technique has first been applied also to the reactive deposition of metal oxides where e.g. a stabilization of the transition regime has been achieved. In the present work, the potential of HPPMS is explored with respect to the reactive deposition of SnO2:Sb with the aim to develop a comprehensive understanding of the correlations between process parameters and film properties. As a first step, some results of the comparison between dcMS and HPPMS will be shown where both the process characteristics and the film properties are discussed.

DS 17.50 Tue 9:30 Poster A

Atomic layer deposition of silicon dioxide with sub nm-precision — •Robert Zierold[1,2], Julien Bachmann[1,2], Yuen Tung Chong[2], Chris Sturm[3], Marius Grundmann[3], Bernd Rheinländer[3], Ulrich Gösele[2], and Kornelius Nielsch[1] — [1]Institut für Angewandte Physik und Zentrum für Mikrostrukturforschung, Universität Hamburg, Germany — [2]Max-Planck-Institut für Mikrostrukturphysik, Halle/Saale, Germany — [3]Abteilung Halbleiterphysik, Universität Leipzig, Germany

Atomic layer deposition (ALD) is suitable for producing homogenous, thin solid films for various applications in micro- and optoelectronics. We have developed a method for the deposition of silicon dioxide by ALD. Exposure of a flat substrate to consecutive pulses of three gaseous precursors (3-aminopropyltriethoxysilane, water, ozone) deposits SiO2 in monolayer by monolayer fashion. The presence of the amino group within the silane precursor is essential to the growth. It catalyzes the cleavage of the strong Si-O bonds and thereby allows the precursor to bond to the surface.

Electron microscopy, atomic force microscopy and spectroscopic ellipsometry evidence the growth of thin, smooth and pure SiO2 films at a rate of 0.6(+/-0.1) Å per cycle. The novel process allows the conformal deposition of SiO2 into porous alumina templates as well, and yields nanotubes of high aspect ratio (˜1000) with tunable diameter (40 to 160 nm) and wall thickness (1 to 50 nm). We are currently exploring applications to Bragg reflectors, complex optical heterostructures and chemically resistant coatings by this process.

DS 17.51 Tue 9:30 Poster A

Realisation of steady state liquid phase epitaxy for growth of polycrystalline silicon layers on amorphous substrates — •Robert Heimburger, Klaus Böttcher, Thomas Teubner, and Torsten Boeck — Institute for Crystal Growth, Berlin, Germany

The growth of polycrystalline silicon layers on amorphous substrates from metallic solutions at low temperatures is one of the present challenges to overcome the problem of producing low cost thin film solar cells. Generally, the solubility of silicon in metals with low melting point is small at these temperatures.

In order to be able to enhance mass transport of silicon to the surface, we apply a modified classical liquid phase epitaxy called *steady state* liquid phase epitaxy. A detailed experimental study of saturation conditions at the surface of the sample when setting up different heating arrangements will be presented. Selective adjustment of growth and dissolution of silicon at the surface of Si(100) and Si(111) can be shown. Experimental findings will be discussed by means of additional finite-element-simulations of temperature and fluid flow behaviour of the growth arrangement.

DS 17.52 Tue 9:30 Poster A

Reactive Deposition of TiO_x and TiN_x Layers in a DC-

Magnetron Discharge — •Stefan Wrehde[1], Marion Quaas[2], Robert Bogdanowicz[3], Hartmut Steffen[4], Harm Wulff[2], and Rainer Hippler[1] — [1]Institute of Physics, University of Greifswald, Felix-Hausdorff-Straße 6, 17489 Greifswald, Germany — [2]Institute of Biochemistry, University of Greifswald, Felix-Hausdorff-Straße 4, 17489 Greifswald, Germany — [3]Department of Optoelectronics and Electronical Systems, Gdansk University of Technology, ul. G. Narutowcza 11/12, 80-952 Gdansk, Poland — [4]Leibnitz-Institute for Plasma Science and Technology e.V., Felix-Hausdorff-Straße 2, 17489 Greifswald, Germany

Thin solid TiO_x and TiN_x films have been deposited by means of a DC magnetron plasma. Reactive gas type (oxygen or nitrogen), reactive gas flow, discharge power and operation mode of the magnetron ("balanced" or "unbalanced") have been varied. Different x-ray techniques (XPS, XR, GIXD) have been applied for research on the chemical composition and the structure of the deposited films. It was found that the operation mode of the magnetron has a significant influence on the incorporation of oxygen or nitrogen into the layers and also the deposition rate. Comparison of the results of oxygen and nitrogen experiments shows that in unbalanced magnetron mode the incorporation of oxygen into the layers is declined as that of nitrogen is enhanced. By additional application of spectroscopic ellipsometry (SE) the results of the x-ray methods could be confirmed and extended by information on the optical properties of the layers.

DS 17.53 Tue 9:30 Poster A

Production and characterisation of bandwidth- and phase-optimised La/B_4C-multilayer-mirrors for the reflection of ultra short XUV-pulses — •Stefan Hendel, Florian Bienert, Maike Lass, Wiebke Hachmann, Marc D. Sacher, and Ulrich Heinzmann — Department of Physics, Bielefeld University

The applicability of reflective optical components for the XUV region depends upon the existence of multilayer-optics. In particular multilayers for the soft X-Ray spectral range calls for new material combinations. For the photon energy range of about 180 eV Lanthanum (La) is favoured as the absorber material and Boroncarbide (B_4C) as the spacer material. Thin periodic layer systems of those materials with double layer periods of 3.5 nm (La/B_4C) have been produced by UHV Electron Beam Evaporation combined with Ion Polishing. In-situ layer thickness control is done by X-Ray Reflectometry and single-wavelength Ellipsometry. The characterisation of the layer purity is done by ex-situ Sputter Auger Spectroscopy, whilst structural analysis is performed by X-Ray Diffraction, Transmission Electron Microscopy and at-wavelength reflectivity measurements with Synchrotron radiation. A further goal are aperiodic (chirped) multilayers which exhibit an optimised spectral bandwidth and spectral phase required for the reflection of ultra short soft X-Ray pulses from High Harmonic Sources. We report on experimental results as well as corresponding simulations.

DS 17.54 Tue 9:30 Poster A

Structure formation in reactively sputtered TiO_2 thin films utilizing dcMS and HPPMS deposition techniques — •Azza Amin, Dominik Koehl, and Matthias Wuttig — I. Institute of Physics IA, RWTH Aachen University

TiO_2 thin films are employed in a wide range of applications, e.g. in self-cleaning, antibacterial, antifogging or optical coatings. The as-deposited films usually either possess an amorphous structure or exist in a mixture of the anatase and the rutile phase. The anatase phase is characterized by a pronounced photocatalytic activity, while the rutile structure exhibits a high mass density and a refractive index of up to 2.8 at 2.25 eV. Due to the different physical properties of these two states, a reliable means for the tailoring of the crystalline phase is therefore desirable. The high power pulsed magnetron sputtering (HPPMS) process is expected to be an appropriate tool for this purpose as it facilitates highly ionized deposition due to extremely high peak currents. To develop a thorough understanding of the structure formation and to deposit films with tailored properties, we have performed a comparative study of dcMS and HPPMS deposition processes with the aim of also establishing a detailed description of the correlation between process parameters and film properties. First results of this study are shown.

DS 17.55 Tue 9:30 Poster A

Preparation of single terminated substrates for oxide superlattices — •Thomas Freudenberg, Ruben Hühne, Bernhard Holzapfel, and Ludwig Schultz — IFW Dresden, Institute for Metallic Materials, P.O. Box 270116, D-01171 Dresden, Germany

Well-defined and nearly perfect single crystal surfaces of oxide perovskites are important for the preparation of oxide superlattices with smooth interfaces. Single terminated surfaces of $SrTiO_3$, $NdGaO_3$ and $YAlO_3$ having steps of one unit cell height and atomically flat terraces were obtained by selective etching using various pH controlled hydrofluoric acid solutions. The effect of annealing in an oxygen environment and of etching conditions on the surface morphology was studied by atomic force microscopy (AFM). It has been demonstrated that perfect surfaces can be achieved with a proper selection of both the annealing temperature and the etching parameters with respect to substrate miscut angle. The prepared single terminated substrates were used to study the homoepitaxial growth of $SrTiO_3$ as well as the heteroepitaxial growth of $SrTiO_3$ on $NdGaO_3$ and $SrRuO_3$ on $SrTiO_3$. Therefore, pulsed laser deposition in combination with high-pressure reflection high-energy electron diffraction (RHEED) was applied to investigate the influence of the different deposition parameters including background pressure, substrate temperature and repetition rate on the film growth behavior. The observed RHEED intensity oscillations and the surface characterization using AFM indicate that a layer-by-layer growth mode was achieved during homoepitaxial and heteroepitaxial growth.

DS 17.56 Tue 9:30 Poster A

Metall-PrCaMnO-Heterostrukturen: Struktur und remanente Widerstandsänderungen — •Julia Fladerer, Jörg Hoffmann, Peter Moschkau und Christian Jooss — Institut für Materialphysik, Universität Göttingen

Remanente Widerstandsänderungen in gepulsten elektrischen Feldern an Oxid-Metall Heterostrukturen sind vielversprechende Kandidaten für neue nichtflüchtige Speicher. PCMO Dünnfilme wurden mittels Ionenstrahlsputtern epitaktisch auf (100)-orientierten Pt-Filmen deponiert. Die Schichtdicke betrug ca. 120nm für die Pt- und 330nm für die PCMO-Schicht. Für verschiedene obere Elektrodenmaterialien (Pt, Au, Ag, Cu, Al, ITO) zeigten die Heterostrukturen stark unterschiedliches Verhalten der remanenten Widerstandsänderungen bei Raumtemperatur sowie der Strom-Spannungs-Kennlinien. Die zur Beschreibung der Manganate verwendeten Modelle der thermisch aktivierten Polaronen und der raumladungsbegrenzten Ströme können diese Beobachtungen nicht erklären. Es wird das Modell eines korrelierten Schottky-Kontaktes entwickelt, der Polaronenverhalten mit Bandverbiegung an der Metall-Oxid Grenzfläche verbindet und so qualitative Übereinstimmungen liefert.

DS 17.57 Tue 9:30 Poster A

Preparation of thin biaxial strained functional oxides — •Sascha Trommler, Thomas Freudenberg, Ruben Hühne, Bernhard Holzapfel, and Ludwig Schultz — IFW-Dresden, Germany

In the last years functional oxides with a perovskite structure as well as structurally related compounds have attracted great interest. It had been shown, that between interfaces of such epitaxial oxides novel electronic structures can be formed or that the biaxial strain induced by the lattice mismatch may affect the physical properties significantly in these materials. A main prerequisite to study these effects is the controlled growth of epitaxial heterostructures on an atomic level in order to achieve smooth interfaces with a low density of defects. Therefore, pulsed laser deposition was used in combination with in-situ RHEED observation to prepare such heterostructures on single terminated atomically flat substrates. Results on the layer-by-layer growth of different functional oxides as $SrRuO_3$, $La_{2-x}Ba_xCuO_4$ and of $LaCoO_3$ will be presented and discussed together with their structural and physical properties.

DS 17.58 Tue 9:30 Poster A

Local variation of dispersion constants of ITO films studied by spectroscopic imaging ellipsometry — •Matthias Vaupel[1] and Mykola Vinnichenko[2] — [1]Nanofilm Technologie GmbH, 37081 Göttingen, Germany — [2]Forschungszentrum Dresden-Rossendorf, Institute of Ion Beam Physics and Materials Research, P.O.Box 510119, 01314 Dresden, Germany

Tin-doped-indium oxide (ITO) is a degenerate n-type semiconductor with high transparency and nearly metallic conductivity. Thin films of ITO find applications as transparent electrodes in optoelectronics (including organic light emitting devices (OLEDs)), photovoltaics, and in the liquid crystal display industry. A standard route of producing ITO films is deposition by magnetron sputtering. The interaction of the magnetron plasma with the growing film surface may be employed

to cause inhomogeneity of the film morphology [1]. The aim of the present work is to study the influence of the intentionally inhomogeneous plasma flow on the distribution of the ITO film thickness and optical properties (dispersion parameters: free charge density, frequency and force of the Lorentz oscillator, and the constant term) along the substrate. Variation of the film properties are investigated both on large (several milimeters) and local (several micrometers) scale.

[1] A. Rogozin, M. Vinnichenko, N. Shevchenko, A. Kolitsch, and W. Moeller, Thin Solid Films 496, 197 (2006).

DS 17.59 Tue 9:30 Poster A

Electrodeposition of porous ZnO on textile substrates — •Markus Mingebach[1], Thomas Loewenstein[1], Yvonne Zimmermann[2], Andreas Neudeck[2], and Derck Schlettwein[1] — [1]Justus-Liebig-Universität Gießen, Institut für Angewandte Physik, Heinrich-Buff-Ring 16, 35392 Gießen — [2]Textilforschungsinstitut Thüringen-Vogtland e.V., Zeulenrodaer Straße 42, 07973 Greiz

Textile integrated photovoltaic cells are of interest to realize a standalone energy supply of textile electronics which are presently developed for applications in safety and health care. A low temperature deposition method of photovoltaic structures (< 150 °C) is required for textiles. Sensitized ZnO as a wide bandgap semiconductor applied in photoelectrochemical photovoltaic cells [1] can be utilized for this purpose. Such ZnO films can be obtained at 70 °C from aqueous zinc salt solutions by electrochemical deposition. By adding the structure directing agent EosinY to the deposition solution, highly porous films with roughness factors of about 200-400 are prepared [2]. In this study we report the growth of ZnO/EosinY hybrid films on metal coated polyamide threads and filaments. The influence of the deposition parameters like current density and hydrodynamic aspects on the electrode parameters was analyzed by scanning electron microscopy (SEM) and photoelectrochemical experiments.

[1] T. Yoshida, M. Iwaya, H. Ando, T. Oekermann, K. Nonomura, D. Schlettwein, D. Wöhrle, H. Minoura, Chem. Comm., 4, 400 (2004) [2] T. Yoshida, M. Tochimoto, D. Schlettwein, D. Wöhrle, T. Sugiura, and H. Minoura, Chem. Mater., 11, 2657 (1999)

DS 17.60 Tue 9:30 Poster A

Study of the formation mechanisms of the polycrystalline thin films of GaSb on non-orienting substrates during forced cooling of saturated solution-melt — •Andrey Sarikov[1], Yevgen Baganov[2], and Stanislav Shutov[1,2] — [1]V. Lashkarev Institute of Semiconductor Physics NAS Ukraine, 45 Nauki avenue, Kiev 03028, Ukraine — [2]Kherson National Technical University, 24 Berislavs'ke highway, Kherson 73008, Ukraine

Thin films of crystalline GaSb on inexpensive non-orienting substrates (e. g. glass) are interesting as a basis for the production of low-cost photovoltaic and thermophotovoltaic converters. In this work, we propose a new method of obtaining thin polycrystalline GaSb films on non-orienting substrates based on a forced cooling of saturated solution-melt of Sb in Ga. The morphology of GaSb layers is studied experimentally as a function of annealing and cooling down conditions. A theoretical model of the process under investigation is suggested and the kinetics of the nucleation and growth of GaSb grains during forced cooling of saturated solution-melt is studied theoretically. The appearance of crystalline GaSb grains is found to be due to the heterogeneous nucleation at the interface of amorphous Sb/Ga+Sb solution-melt with the vacuum surrounding. The optimisation procedure for the formation of polycrystalline GaSb films on non-orienting foreign substrates with respect to process duration and final grain size is studied. The process described is also proposed to use for the formation of the polycrystalline thin films of other A3B5 semiconductors on the non-orienting foreign substrates.

DS 17.61 Tue 9:30 Poster A

An in situ GISAX study on the shape anisotropy of sputter grown Ta — •Kai Schlage, Sebastien Couet, Ralf Röhlsberger, Andreas Timmmann, and Stephan Roth — Deutsches Elektronen Synchrotron (DESY), Hamburg, Germany

It is well known that the shape anisotropy of polycrystalline grains in thin films can strongly influence their intrinsic magnetic properties like magnetic hard and easy axes. Also buffer layers contribute to this effect. We use Grazing Incidence Small Angle X-Ray Scattering (GISAXS) to follow in-situ the structural evolution of obliquely sputter deposited Ta onto a Si wafer which is often used as buffer layer in magnetic thin film systems. GISAXS allows to follow the growth process of the films and yields the size, shape and the lateral correlations of surface structures like nanoislands in the initial stage of film growth [1]. We found a strong growth anisotropy of the Ta which can be directly related to the sputtering geometry.

[1] S.V. Roth et al., Applied Physics Letter 88, 021910 (2006)

DS 17.62 Tue 9:30 Poster A

Metal organic chemical vapour deposition of $SrRuO_3$ thin films on $SrTiO_3$ — •Rasuole Dirsyte, Jutta Schwarzkopf, Günter Wagner, and Roberto Fornari — IKZ, Max Born - Straße 2, D - 12489 Berlin, Germany

$SrRuO_3$ with pseudo-cubic crystalline structure (a = 0.393 nm) appears to be one of the most suitable conductive oxides to be used as bottom electrode for the oxide-based electronic devices, due to its high conductivity and low lattice misfit with many functional perovskite transition metal oxides [1]. Furthermore, this electrode has a lower density of defects (oxygen vacancies, dislocations, dead layer) compared with metal electrodes (Pt, Ru, Ir) [2].

A vertical liquid-delivery metal-organic chemical vapour deposition (MO-CVD) reactor was used to deposit (100)-oriented $SrRuO_3$ films on vicinal $SrTiO_3$(100) substrates. In order to grow epitaxial thin films with low defect density and high electrical conductivity and to optimise the deposition parameters, the influence of deposition temperature (500 - 700 °C), argon/oxygen ratio (1,6 - 3,3), total gas flow (4875 - 8125 sccm) and reactor pressure (12 mbar - 40 mbar) was investigated.

Composition of the films was identified by GDOES technique. Raman and XRD were used to determine film orientation and the surface morphology and roughness was analysed by AFM and SEM microscopy.

[1] O. Gautreau, C.Harnagea, F. Normandin, T.Veres, A. Pignolet, Thin Solid Films 515, 4580 (2007).

[2] N. Menou, H. Kuwabara, and H. Funakubo, Jpn. J. Appl. Phys. 46, 2139 (2007).

DS 17.63 Tue 9:30 Poster A

Influence of growth conditions on surface morphology, structural and optical properties of $PbSnTe/BaF_2/CaF_2/Si(100)$ heteroepitaxial structures — •Dmitriy Ostertak[1], Alexander Velichko[1], Vladimir Ilyushin[1], Marion Friedrich[2], and Dietrich R.T. Zahn[2] — [1]Novosibirsk State Technical University, Novosibirsk, Russia — [2]Chemnitz University of Technology, Chemnitz, Germany

Epitaxial films of group II fluoride insulators grown on silicon are used to produce semiconductor-on-insulator structures and buffer layers for heteroepitaxy. Among them, the most promising candidates are Si / CaF_2 / Si and PbSnTe / BaF_2 / CaF_2 / Si structures which are used to manufacture high-speed radiation-resistant very large scale integrated circuits and monolithically integrated photodetector arrays. Most of the published papers are devoted to CaF_2 and BaF_2 epitaxy processes on silicon surfaces with (111) orientation while the (100) orientation is more attractive for solving technical applications mentioned above.

CaF_2 / Si(100), BaF_2 / CaF_2 / Si(100) and PbSnTe/BaF_2 / CaF_2 / Si(100) heteroepitaxial structures were grown by Molecular-Beam Epitaxy at different growing conditions. The surface morphology was investigated by Atomic Force Microscopy (AFM). The optimal growing conditions for CaF_2 on Si(100), BaF_2 on CaF_2 / Si(100), and PbSnTe on BaF_2 / CaF_2 / Si(100) were determined from AFM measurements. Fourier transform infrared spectroscopy and spectroscopic ellipsometry were used to study optical properties and to measure thickness of these films. The influence of different growth conditions on optical and structural properties is discussed.

DS 17.64 Tue 9:30 Poster A

Measurement of the internal mechanical dissipation in dielectric thin films — •Stefanie Kroker[1], Christian Schwarz[1], Daniel Heinert[1], Ronny Nawrodt[1], Anja Schroeter[1], Ralf Neubert[1], Matthias Thürk[1], Sandor Nietzsche[1], Wolfgang Vodel[1], Andreas Tünnermann[2], and Paul Seidel[1] — [1]Institut für Festkörperphysik, Helmholtzweg 5, 07743 Jena, Germany — [2]Institut für Angewandte Physik, Albert-Einstein-Straße 15, 07745 Jena, Germany

Gravitational wave detectors currently under operation are limited by different kinds of noise. One of the fundamental noise sources of future detectors will be thermal noise arising from the dielectric coatings of the optics. In order to fulfil the requirements for the third generation gravitational wave detectors it is necessary to reduce the mechanical dissipation of the dielectric thin films by at least a factor of 2. Thus, it is necessary to understand the internal mechanisms that cause mechan-

ical loss. We present a novel set-up to measure the internal mechanical dissipation of thin films ($< 1\,\mu$m) on silicon substrates. We present results for tantala (Ta_2O_5) and silica (SiO_2) within a temperature range from 5 to 300 K.

This work is supported by the German science foundation under contract SFB Transregio 7.

DS 17.65 Tue 9:30 Poster A

Dielektrische Bragg–Spiegel für Zinkoxid–Mikrokavitäten — •A. Dempewolf, A. Franke, A. Diez, B. Diez, J. Bläsing, T. Hempel, J. Christen und A. Krost — Institut für Experimentelle Physik, Otto-von-Guericke-Universität Magdeburg, Deutschland

Zur Herstellung von ZnO-basierten Mikrokavitäten sowie Polaritonen-Lasern werden qualitativ hochwertige Bragg-Spiegel (DBR) benötigt. Das epitaktische Wachstum dieser auf Grundlage von MgZnO gestaltet sich jedoch schwierig. Eine Alternative bietet die Verwendung von dielektrischen Materialien. Es wurden dielektrische DBRs bestehend aus $\lambda/4$ – Tantal(V)- und Silizium(IV)oxid-Schichten auf Silizium-Substrat mittels Elektronenstrahlverdampfen abgeschieden. Aufgrund der hohen Brechungsindexdifferenz beider Materialien von 0,6 im Bereich der exzitonischen Lumineszenz von ZnO ($I_8 = 3{,}36$ eV) konnten bereits bei 10,5 Schichtpaaren eine Reflektivität von über 99,5 % und eine Weite des Stoppbandes von 540 meV erreicht werden. Vergleichend dazu erfolgte die Herstellung der DBRs basierend auf den hochbrechenden Materialien Hafnium(IV)- und Zirkon(IV)oxid. In einem weiteren Schritt wurden auf einen 10,5 - paarigen unteren Spiegel eine $3\,\lambda/2$–Silizium(IV)oxid-Kavität und ein 10 - paariger oberer Spiegel abgeschieden. Das Reflexionsspektrum weist eine Kavitätsmode bei 3,28 eV mit einem Q-Faktor von 130 auf. Ein effizientes optisches Pumpen der aktiven Zone wird durch eine hohe Transmission im Bereich der HeCd-Laserlinie bei 3,81 eV ermöglicht. Zum Erzielen einer starken Licht-Materie-Kopplung wurde eine gesputterte ZnO-Schicht als aktives Medium in die Struktur integriert.

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