DS 24 Poster presentation

Time: Tuesday 15:00–17:30 Room: P2

DS 24.1 Tue 15:00 P2

Argon: bulk, sheets and nanotubes — •Karin Schmalzl[1,2], Maikel Rheinstaedter[2], and Dieter Strauch[3] — [1]Forschungszentrum Juelich, 52425 Juelich, Germany — [2]Institut Laue-Langevin, BP 156 - 38042 Grenoble, France — [3]Institut fuer Theoretische Physik, Universitaet Regensburg, Germany

Condensed matter in geometrical confinement like nanoporous matrices allows to study the change of dynamics due to spatial restrictions. We investigated ^{36}Argon adsorbed in nanoporous Gelsil Glass by inelastic neutron scattering. At low filling fractions the atoms form an amorphous adsorbate film on the pore walls. At higher fillings, a capillary condensate forms in the pore center. The preparation of single or of several monolayers were possible what permitted the study of, e.g., the dynamical interaction between the third and second layer.

We compare the measured density of states of different fillings with the ones calculated with ab initio calculations . The calculations were done with LDA and GGA pseudopotentials. We studied rods and hollow cylinders with different number of atoms to appraoch the different fillings of the pores.

We also investigated the dynamics of a 2D system like a monolayer, double layer and several layers of atoms and followed in this way the transition to the bulk state.

DS 24.2 Tue 15:00 P2

Self-Organized Surface Patterning — •Michael Hirtz[1,2], Xiaodong Chen[1,2], Harald Fuchs[1,2], and Lifeng Chi[1,2] — [1]Physikalisches Institut WWU Münster, Wilhelm-Klemm-Straße 10, 48149 Münster — [2]CeNTech, Gievenbecker Weg 11, 48149 Münster

Surface patterning is of great importance in modern science and technology. Patterning is usually achieved by top-down strategies, such as optical and e-beam lithography, soft-lithography, scanning probe lithography, and nanoimprint lithography. In contrast, the concepts of self-assembly and self-organization provide another interesting route toward the formation of patterned structures via a bottom-up approach. Here, we present the formation of regular striped patterns in a self-organized manner by means of Langmuir-Blodgett (LB) technique, and their applications.

DS 24.3 Tue 15:00 P2

Reorganisation of ultrathin PEO films by water exposure — •Evelyn Meyer and Hans-Georg Braun — Leibniz Institute of Polymer Research, Max-Bergmann Center of Biomaterials, D-01069 Dresden, Hohe Strasse 6

Ultrathin PEO films (thickness < 5 nm) which are prepared by dip-coating can crystallize in highly branched lamella structures which are caused by a diffusion controlled growth process within the thin polymer layer. The water soluble polymer can rearrange on the surface by water exposure. We used a inkjet based microdroplet generator to deposit small ($\approx$ 80 micrometer) sized water droplets on the ultrathin film. Dissolution of the PEO film within the water droplet impact zone results in micropatterned PEO films. The morphological features resulting from the water droplet impact give information about the size of the impact zone on the surface and about the dissolution and reorganisation processes of the PEO molecules. Within the impact zone dewetting layers were observed and dendritic PEO lamellae growing from the rim inside the impact zone are identified and discussed. An experimental setup in which a thin water layer entrapped in a slit between a truncated pyramidal made and an ultrathin PEO layer can be moved with defined velocities across the PEO film will be used to demonstrate the reorganisation processes of (partly) dissolved PEO films both on homogeneous and heterogeneous surfaces.

DS 24.4 Tue 15:00 P2

Domain shape dynamics and local viscosity in stratifying foam films — •Peter Heinig — MPI für Dynamik und Selbstorganisation, Bunsenstr. 10, 37073 Göttingen

For the development of microfluidic devices (the lab on a chip) the effect of an interface on bulk parameters, as viscosity, is an issue of great importance. Nevertheless experimental results on local viscosity are rare and partially contradictory. We studied the domain shape dynamics in a foam film composed of oppositely charged surfactant and polyelectrolyte. These films thin in stepwise fashion: circular domains of lower film thickness are formed, expand and coalesce until they cover the whole film surface. On the one hand we analyzed the shape relaxation of coalescing domains and retreating stripes, on the other hand the dynamics of domain growth. Both kinds of dynamic events represent independent ways for measuring local film viscosity. We found consistent results and an increase of film viscosity of almost two orders of magnitude compared to bulk. The effect can be explained by strong interactions between surfactant and polyelectrolyte.

DS 24.5 Tue 15:00 P2

Calculation of the Evolution of Surface Area and Free Volume During the Infiltration of Fiber Felts — •Andreas Pfrang[1], Katja Schladitz[2], Andreas Wiegmann[2], and Thomas Schimmel[1,3] — [1]Institute of Applied Physics, University of Karlsruhe, D-76128 Karlsruhe, Germany — [2]Fraunhofer Institut für Techno- und Wirtschaftsmathematik, D-67653 Kaiserslautern, Germany — [3]Institute of Nanotechnology, Forschungszentrum Karlsruhe, D-76021 Karlsruhe, Germany

Carbon-carbon composites offer a unique combination of excellent mechanical properties, high thermal stability and low mass density. For the chemical vapor infiltration of pyrolytic carbon the ratio of surface area to free volume A/V plays a crucial role in understanding and modeling the deposition process. Here, the evolution of surface area and free volume during the infiltration of fiber felts was calculated quantitatively, using both an analytical approach and numerical calculations.

A/V was obtained analytically with a Boolean model using the approximation of overlapping fibers. For this model, we find that A/V increases linearly with the radius of the fibers. The model also allows to estimate surface area and free volume for felts with non-overlapping fibers for low initial filling factors.

In addition, numerical calculations of the evolution of A/V were performed. Models of felts with randomly distributed, non-overlapping fibers with different degrees of orientation anisotropy, including parallel fibers and isotropic orientation of the fibers, were generated. It is shown that A/V increases nearly linearly.

DS 24.6 Tue 15:00 P2

Growth of axially textured Bismuth layers on amorphous substrates — •Christian Patzig[1], Ingo Uschmann[2], Frank Schmidl[1], Ortrud Wehrhan[2], Matthias Grube[1], and Paul Seidel[1] — [1]Institut für Festkörperphysik, Friedrich-Schiller-Universität Jena, Helmholtzweg 5, 07743 Jena, Germany — [2]Institut für Optik und Quantenelektronik, Friedrich-Schiller-Universität Jena, Max-Wien-Platz 1, 07743 Jena, Germany

The growth of thin bismuth layers on floatglas was investigated. Thermal evaporation and Pulsed Laser Deposition (PLD) were used as deposition techniques, and X-ray diffraction by means of the Bragg-Brentano-geometry was used to investigate the crystalline structure of the layers. It could be observed that the evaporated layers show an out-of-plane - texture, in contrast to the layers grown on glas by using PLD, which in general are of polycristalline nature. The layers deposited by thermal evaporation show the c-axis as preferred direction of growth. By deposition of a thin evaporated seed layer followed by PLD, homoepitaxy could be induced, leading to a reduction of the FWHM of the rocking curves of the (003) - and respectively (006) - peak, depending on layer thickness and substrate temperature. It was possible to grow layers with an FWHM (003) < 1° on amorphous floatglas. Possible applications of those layers are discussed.

DS 24.7 Tue 15:00 P2

Method of Crystallization Mechanism Control During Epitaxy from Solution-Melt — •Yewgen Baganov, Stanislav Shutov, Vladislav Kurak, and Olena Andronova — Kherson National Technical University, 24, Berislavske shose, Kherson, 73008, Ukraine

Liquid phase heteroepitaxy difficulties appeared due to chemical potentials of solution-melt and substrate are differ and lattice constants of epitaxial layer and substrate are usually mismatched lead to violation of crystallization interface. As a result, it leads to deviation of epitaxial layer thickness and composition from needed ones for realization of planar device structure based on heterojunctions.

Mechanical stress that appears at heteroepitaxy and produce both increasing of solid phase chemical potential and crystallization interface perturbation, demands a short period additional supercooling on crystallization interface and high crystallization rate during initial stages of growth. To provide high structural perfection after initial growth the long period of equilibrium crystallization must follow.

Foregoing facts lead to main requirement to heat flow through substrate: it must be easy controlled, low inertial and time unlimited.

In present work we consider a possibility of substrate cooling by external reactor gas feeding for producing of crystallization conditions that consecutively combine properties both pulse and with quasiequilibrium conditions growth methods.

Model of heat-mass transfer for a priori determination of cooling gas consumption was examined experimentally.

DS 24.8 Tue 15:00 P2

Decorated twin boundaries in homoepitaxy on Ir(111) — •Sebastian Bleikamp[1], Arne Thoma[1], Gerhard Pirug[2], and Thomas Michely[1] — [1]I. Physikalisches Institut, RWTH Aachen University, 52056 Aachen, Germany — [2]Institut für Schichten und Grenzflächen, Forschungszentrum Jülich GmbH, 52425 Jülich, Germany

Scanning tunneling microscopy and low energy electron diffraction were used to investigate the growth of thin Ir films on Ir(111).

A transition from the expected layer-by-layer to a defect dominated growth mode with a fixed lateral length scale and increasing roughness is observed. During growth the majority of the film area is stably transformed to twinned stacking. This transition is driven by the energetic avoidance for the formation of intrinsic stacking faults compared to two independent twin faults, and the existance of preferential nucleation sites at incoherent twin boundaries. These boundaries are decorated by rows of atoms (decoration rows) which replicate themselves in subsequently grown layers and determine the kinetics of growth and stacking.

DS 24.9 Tue 15:00 P2

Reactive Deposition of TiO_x-Layers in a DC-Magnetron Discharge — •Stefan Wrehde[1], Marion Quaas[2], Hartmut Steffen[1], Oleg Zhigalov[1], Harm Wulff[2], and Rainer Hippler[1] — [1]Institute of Physics, Ernst-Moritz-Arndt-University Greifswald, Domstraße 10a, D-17489 Greifswald, Germany — [2]Institute of Chemistry and Biochemistry, Ernst-Moritz-Arndt-University Greifswald, Soldmannstraße 16, D-17489 Greifswald, Germany

The properties of thin solid films produced by plasma activated deposition are strongly influenced by the ions hitting the substrate. To get information about type, energy and density of these incoming ions a DC magnetron plasma for reactive deposition of TiO_x-layers was characterized under different discharge conditions by means of energy resolved mass spectrometry. Absolute values of the ion current densities of the different species could be obtained by using the ion saturation current. It was found that discharge power, chamber pressure, reactive gas flow and operation mode of the magnetron influence the shapes of the IVDF as well as the ion current densities.

In the second step TiO_x-layers were deposited under the examined conditions and investigated using different X-ray-methods as X-ray photoelectron spectroscopy and X-ray reflectometry and diffractometry at grazing incidence. These measurements showed that the deposition rates are higher and the incorporation of oxygen into the layers is lower in unbalanced mode.

DS 24.10 Tue 15:00 P2

Oxide - noble metals - nanocomposites for gas sensing applications — •Sajid U. Khan[1], Giray Kartopu[1], Andre Piorra[1], Klaus Rätzke[2], Claus-Henning Solterbeck[1], and Mohammed Es-Souni[1] — [1]Institute for Materials and Surface Technology, Kiel University of Applied Sciences, Kiel, Germany — [2]Technical Faculty, Chair of Multicomponent Materials, Christian-Albrechts-University, Kiel, Germany

We report on the processing of TiO_2 and SnO_2-noble metal thin film nanocomposites using a one step sol-gel method. The films were spin coated on oxidized silicon substrates and subsequently annealed at temperatures as low as 400°C. The noble metals essentially Pt and Au were added to the oxide precursor solutions either in form of colloidal solutions or as an acid compound. Microstructural characterization included Raman spectroscopy, XRD, X-ray porosimetry and electrical force microscopy (EFM). The gas sensing properties in reducing gases such as hydrogen and carbon monoxide were investigated using a custom set-up at different temperatures. It is shown that mesoporous nanocrystalline thin films of both oxides with embedded nanoparticles of Pt or gold can be obtained. The EFM investigations show homogeneously distributed noble metal nanoparticles. Preliminary results on gas sensing properties indicate high sensitivities at temperatures as low as 250°C.

DS 24.11 Tue 15:00 P2

Structural and optical characterization of $CuAlO_2$ thin films prepared by RF reactive sputtering — •Yinmei Lu, Bin Yang, Angelika Polity, Christian Neumann, Dietmar Hasselkamp, Niklas Volbers, and Bruno K. Meyer — I. Physikalisches Institut, Justus-Liebig-Universität Giessen, Heinrich-Buff-Ring 16, D-35392 Giessen, Germany

Transparent $CuAlO_2$ thin films have been deposited on various kinds of substrates such as float glass, quartz and single-crystal sapphire by RF reactive sputtering using a stoichiometric $CuAlO_2$ ceramic target. The ceramic target with a diameter of 7.8 cm and 7 mm in thickness was self-made via a traditional ceramic fabrication process. X-ray diffraction (XRD) identified a single delafossite $CuAlO_2$ phase of the ceramic target. The thin films were typically deposited with a fixed sputter power of 300 W at room temperature, and then annealed in air at temperatures between 900 and 1100 °C. X-ray diffraction revealed that the as-sputtered films are amorphous, which crystallize during annealing evolving a mixture phase of $CuAlO_2$, $CuAl_2O_4$, and elemental Al. The surface morphology of the films was characterized by scanning electron microscopy (SEM). The composition and homogeneity of the films were examined using Rutherford backscattering spectroscopy (RBS) and secondary ion mass spectroscopy (SIMS), respectively. Typically the films are slightly Al-rich and have good depth homogeneity. The absorption coefficients and optical bandgaps of the films were estimated by optical transmission measurements at room temperature, which revealed a bandgap of 3.3-3.8 eV of the sputtered and annealed $CuAlO_2$ films.

DS 24.12 Tue 15:00 P2

Thickness Dependence of Optical Properties of Amorphous Indium Oxide Thin Films Deposited by Reactive Evaporation — •Kemal Ulutas and Deniz Deger — Istanbul Univ., Sci. Fac., Physics Dep.,Vezneciler,Istanbul,Turkey

Conductivity and absorption coefficient of amorphous indium oxide (IO) thin films, thermally evaporated on glass substrates at room temperature, were evaluated. We attribute the variation of absorption coefficient with thickness to the variation of band gap energy rather than optical interference.

*K.Ulutas Corresponding author : hku@istanbul.edu.tr Fax: +212 519 08 34 Keywords: Thin films, indium oxide

DS 24.13 Tue 15:00 P2

Influence of optical concentration on the properties of Indium oxide thin films — •Nevin Kalkan — Istanbul Univ., Science Faculty, Physics Dept. Vezneciler/ Istanbul - TURKEY

Current - voltage characteristics of Indium-embedded Indium oxide thin films (550-850 Å) with Ag electrodes approximately 1000 Å in thickness, prepared by reactive evaporation of pure indium in partial air pressure were studied. The electrical and optical properties of these films have been investigated as a function of optical concentration. It is seen that the I-V characteristics of all the samples are non-ohmic independent of optical concentration. The conductivity of the films was also seen to increase with the optical concentration. Furthermore, for possible conduction mechanism were proposed.

Keywords: Conduction mechanism, Poole-Frenkel mechanism, chalcogenide

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DS 24.14 Tue 15:00 P2

Infrared spectroscopy of metallic nanostructures — •T. Kolb[1], M.E. Toimil-Molares[2], T.W. Cornelius[2], F. Neubrech[1], F. Kost[1], S. Karim[3], R. Neumann[2], A. Pucci[1], and G. Fahsold[1] — [1]Kirchhoff-Institut für Physik, Universität Heidelberg, Im Neuenheimer Feld 227, 69120 Heidelberg — [2]Gesellschaft für Schwerionenforschung, Planckstr. 1, 64291 Darmstadt — [3]Fachbereich Chemie, Philipps-Universität Marburg, Biegenstr. 10, 35032 Marburg

We investigated the IR-optical properties of single metal nanowires and nanoslits in metal thin films. The wires were prepared by template directed growth of metal in etched ion track polycarbonate membranes.

We dispersed these several ten micrometer long wires on IR-transparent substrates. Applying a shadowing technique the dispersed Cu wires were also used as masks for the preparation of nanosized slits in ultrathin Au films. Investigations of broadband IR optical properties of single nanowires and nanoslits were performed by IR spectroscopic microscopy at the synchrotron radiation source ANKA (Forschungszentrum Karlsruhe). Using this contact free measurement technique we can distinguish between a metallic and a non-metallic behaviour of a single nanowire. For quantitative analysis we try to simulate the spectra to determine the value of conductivity. Our results for the corresponding nanoslits with a width of a few hundred nanometers and a length in the ten micrometer range show a transmission which increases with wavenumber and which exceeds the transmission of the continous Au film in the mid-infrared range. We compare this behaviour to calculations of the small-slit transmission coefficient from classical electromagnetic scattering theory.

DS 24.15 Tue 15:00 P2

Reactively sputtered TiO_2 layers on SnO_2:F substrates: a Raman and SPS study — •Julius Mwabora[1], Klaus Ellmer[2], Abdelhak Belaidi[2], Jörg Rappich[2], and Thomas Dittrich[2] — [1]Department of Physics, University of Nairobi, P.O. Box 30197-00100 Nairobi, Kenya — [2]Hahn-Meitner-Institut, Glienicker Str. 100, 14109 Berlin, Germany

Reactively sputtered TiO_2 layers on SnO_2:F substrates were investigated by Raman and surface photovoltage spectroscopy (SPS). The deposition temperature, the O_2 / (O_2 + Ar) ratio and the deposition time were changed systematically. With increasing temperature, the layers become crystalline while rutile is dominating. Anatase starts to form at prolonged deposition and at lower O_2 / (O_2 + Ar) ratios. The workfunction and its light induced change show only well defined trends for the temperature dependent deposition (increase with increasing deposition temperature). Since the SPS saturates under absorption, the SPS signal is related to the density of states in the spectral region near the band gap of the TiO_2. The values of the band gap and of the energy parameter of the exponential tails decrease from about 3.28 and 140 meV to 3.14 and 60...80 meV with increasing deposition temperature of about 30 °C to 380 °C. The TiO_2 layers deposited at 380 °C are of high electronic quality as demonstrated with SnO_2:F / TiO_2 / graphite Schottky-diodes.

DS 24.16 Tue 15:00 P2

Mechanisms of electron emission from silver cluster films under femtosecond laser excitation — •A. Gloskovskii, D.A. Valdaitsev, S.A. Nepijko, and G. Schönhense — Institut für Physik, Johannes Gutenberg - Universität, 55099 Mainz

The electron yield from metal cluster films upon fs-laser irradiation is several orders of magnitude larger than for bulk metal. Depending on various parameters, electrons can be emitted due to different processes. *Multiphoton photoemission* (*n*PPE) is basically rather well understood. For the case of metal clusters *n*PPE can be governed by the strong enhancement of the optical near field caused by plasmon excitation. In this contribution we focus on the alternative emission processes, i.e. *thermionic emission, thermally assisted n*PPE and *optical field emission*. In order to understand the differences between the competing channels it is necessary to consider the details in the thermalization of the initially excited electron system. Further, a quantum-statistical model gives a quantitative estimation of the different regimes of emission mechanisms.

A FOCUS PEEM with retarding field imaging energy filter was used in combination with a Spectra Physics laser [MaiTai tunable between 750 and 850 nm ("red", 100 fs) and frequency doubled ("blue", 200 fs)]. UHV-deposited Ag/Si cluster films of various mass thicknesses have been investigated using "blue"and "red"excitation. The Fermi level onset is sharp (less than 150 meV wide) in the "blue"photoelectron spectra, while it is smeared out under "red"laser excitation. A contribution of *thermally assisted 2*PPE and *optical field emission* was found in addition to pure *3*PPE under "red"laser excitation.

DS 24.17 Tue 15:00 P2

Growth and electronic structure of ultrathin KCl layers on Cu(111) — •Robin Ohmann[1], Michael Vogelgesang[1], Oguzhan Gürlü[1], Lars Diekhöner[2], M. Alexander Schneider[1], and Klaus Kern[1] — [1]Max-Planck-Institut, Nanoscale Science Department, Stuttgart, Germany — [2]Aalborg Universitet, Institut for Fysik og Nanoteknologi, Aalborg, Denmark

Thin films of insulating materials on conducting surfaces are of great interest as decoupling layers for adsorbates. In the single to few monolayer regime these films can still be investigated by Scanning Tunneling Microscopy and Spectroscopy (STM/STS). Ideally the insulating layer should not provide any electronic structure within its electronic gap. This was checked for the case of ultrathin KCl layers grown in UHV on Cu(111) by low-temperature STM/STS measurements. The Cu(111) surface state is shown to evolve into an interface state with an almost identical dispersion relation in contrast to findings in the NaCl/Cu(111) system (1). Therefore the electronic changes introduced by the KCl are found to be minimal; the layer behaves like an additional tunneling barrier. KCl covered Cu is yet still clearly distinguishable from the Cu(111) surface by measuring the image-potential states. At voltages of 2.7V we identify the onset of a conduction band derived state of the KCl layer. This state is followed by the Stark-shifted series of image-potential states. A detailed discussion of the observed STS spectra at high positive sample bias will be presented.

[1] J. Repp, G. Meyer, K. H. Rieder, PRL 92, 036803 (2004)

DS 24.18 Tue 15:00 P2

Electrical transport mechanisms in growing Pd thin films - modified by hydrogen loading — •Stefan Wagner, Olof Dankert, and Astrid Pundt — Institut für Materialphysik, Georg- August- Universität Göttingen, Friedrich- Hund- Platz 1, 37077 Göttingen

During thin film growth the electrical resistivity of the film changes within orders of magnitude. Different conduction mechanisms can be identified, dominating the conductivity in the different stages of growth. These stages depend on the substrate that, on the one hand, modifies the shape of the islands and, conversely, contributes differently to the conduction mechanisms.

Resistance measurements during thin film growth are presented and divided into regimes where charge tunnelling, island percolation and thin film properties are dominating. The conduction regimes are described in terms of thermally activated tunnelling, percolation theory and modified Fuchs- Sondheimer theory, and the model parameters are determined.

The influence of hydrogen loading on the conduction behaviour of a discontinuous film is shown and appears strongly substrate dependent. It will be discussed in terms of magnitude, reversibility and switching time.

DS 24.19 Tue 15:00 P2

Characterisation of thin PTFE-like fluorocarbon films produced using plasma deposition processes — •Vasil Yanev[1,2], Marcel Himmerlich[1,2], Stefan Krischok[1,2], Gabriel Kittler[2], Oliver Ambacher[2], and Juergen A. Schaefer[1,2] — [1]Institut für Physik, TU Ilmenau, P.O. Box 100565, 98684 Ilmenau, Germany — [2]Zentrum für Mikro- und Nanotechnologien, TU Ilmenau, P.O. Box 100565, 98684 Ilmenau, Germany

Fluorocarbon (FC) thin films are attractive for optical, tribological, microelectronics and Micro-Electro-Mechanical Systems (MEMS) applications because of their unique surface and physical properties. Thin PolyTetraFluoroEthylene-like (PTFE-like) films were deposited on Si(111) using plasma polymerisation at various process conditions. To characterise the properties of these films different techniques such as X-ray Photoelectron Spectroscopy (XPS), ellipsometry, electrical and contact angle measurements were applied. XPS spectra (C1s peaks) indicate the presence of CF_3, CF_2, CF, and C–C bonds typical for crosslinked and/or branched PTFE-like plasma polymer structures. All FC coatings show a very low surface free energy (sessile contact angle with water varying between 103° and 115°), very low refractive indexes varying between 1.35 and 1.44 and excellent dielectric properties (measured dielectric constant, thin film breakdown voltage, field strength and leakage current).

DS 24.20 Tue 15:00 P2

Tuning the surface plasmon resonance in polymer-bimetallic (Au-Ag) nanocomposites — •Venkata Sai Kiran Chakravadhanula, Haile Takele, Henry Greve, Mady Elbahri, Vladimir Zaporojtchenko, and Franz Faupel — Chair for Multicomponent Materials, Technical Faculty of the CAU Kiel, Kaiserstr. 2, 24143 Kiel, Germany.

Nanocomposite thin films with noble metal nanoparticles embedded in or on top of a dielectric material show attractive optical properties at the surface plasmon resonance (SPR) wavelength due to dielectric and quantum confinement effects. Their optical response at SPR can be used in various applications like Raman Spectroscopy, surface enhanced fluorescence, color filters, sensors and optical switching devices. In this

work, we applied a vapor phase tandem deposition method to generate polymer-metal nanocomposites. We observed core-shell type structures after tandem deposition of Au and Ag on polystyrene. Thermal annealing of these led to SPR shift due to alloy formation. We also produced sandwich structures consisting of nanoclusters of different metals separated by a thin polymer barrier. By tailoring parameters like metallic concentration and by sandwiching the Au/Ag particles between polymer with different thickness, the multiple plasmon resonances can be tuned over a wide visible wavelength range.

DS 24.21 Tue 15:00 P2

Optical and electrical detection of hydrogen at room temperature based on MgNi switchable mirrors — •Baker Farangis, Jennifer Stiebich, Bruno K. Meyer, and Dietmar Hasselkamp — I. Physikalisches Institut, Justus Liebig Universität, Heinrich Buff Ring 16, 35392 Giessen

Metallic films of MgNi including a thin palladium cap-layer prepared by RF sputtering exhibit a reversible switching behavior from a highly reflecting to a transmitting state upon hydrogenation and dehydrogenation. The principle of a switchable mirror can be used in an optical sensor to detect hydrogen gas. It bases on a reversible metal-insulator-transition (MIT) upon hydrogen absorption. The MIT also changes the electrical conductivity, therefore in an electrical sensor, the change in conductivity can be used for hydrogen detection. The signal intensity before and after hydrogen take up (4% H_2 in Argon and at room temperature) is stable, and the hydrogen absorption is a fast process. It reaches for the optical sensor within 10 seconds 90% of the maximum value (t_{90}), and for the electrical sensor it is 1 second, considerably faster. The sensitivity of the sensors as a function of the hydrogen concentration was investigated (1-4% H_2 in Ar) and shows an exponential connection.

DS 24.22 Tue 15:00 P2

Electrical and optical properties of electrodeposited Cr ultra-thin films on Si (100) substrate — •Violeta Georgescu and Cristina Sirbu — Faculty of Physics, Al. I. Cuza University, Iasi, Romania

Electronic transport properties of ultra-thin films and of nanometer-sized crystallites of metals deposited onto semiconductors play an important role for the development of nanoscaled electronic devices. In this work, we report the electrical and optical properties of ultra-thin films (2 nm * 50 nm) composed of Cr nano-crystal electrodeposited onto silicon single crystal. The films were prepared by electrodeposition from a solution based on CrO_3 under potentiostatic conditions. Atomic force microscopy has been employed to investigate the morphology of ultra-thin films and the distribution of the Cr nano-crystals grown by this method on n-type Si (100) substrate P-doped. Reflection spectra for ultra-thin Cr/Si films with various thicknesses were recorded in the photon energy range 1.18*3.1eV using a computer controlled STEAG-ETA Optic Spectrometer. Electronic transport behavior performed at room temperature in the plane of the films revealed the type of electrical conduction. Analysis of photo-resistance for various samples allows us to detect the onset of metallic conductivity due to percolation of island-like Cr metal films onto semiconductor substrate. In the case of very small Cr nano-crystals one can observe specific quantum size effects

DS 24.23 Tue 15:00 P2

Annealing effects on VO_2 thin films deposited by reactive sputtering — •Ganhua Fu, Angelika Polity, Niklas Volbers, and Bruno K. Meyer — I. Physikalisches Institut, Justus-Liebig-Universität Giessen, Heinrich-Buff-Ring 16, D-35392, Giessen

Due to the switching of the optical properties at semiconductor-metal phase transition, VO_2 can be used as infra-red light (IR)-switching or bolometric devices or as intelligent energy conserving window coating. In this work, two VO_2 film systems (bare VO_2 film on float glass and W doped VO_2 film with a TiO_2 capping layer) were deposited by radio-frequency reactive sputtering. Their thermal stability was investigated by annealing the films in air at different temperatures. It was found that the VO_2 thin film is quite stable in air below 200 °C. However, after annealing in air at 300 °C, the pure VO_2 film was oxidized to a V_2O_5 film. The W doped VO_2 layer with a TiO_2 capping layer lost its switching property after annealing at 400 °C for 10 min due to inter-diffusion.

DS 24.24 Tue 15:00 P2

Indentation and shear of thin fluorocarbon films on silicon substrate — •Yonghe Liu, Mikhail Kosinskiy, Vasil Yanev, Stefan Krischok, and Juergen A. Schaefer — Institut für Physik und Zentrum für Mikro- und Nanotechnologien, Technische Universität Ilmenau, 98693 Ilmenau, Germany

Deposition of a thin polytetrafluoroethylene-like fluorocarbon (FC) film on Si can reduce its adhesion to various substances including water significantly, and thus has potential applications in microelectromechanical systems. However, the adhesion of FC on Si substrate is also weak, which might lead to debonding and other damages of the films under both compression and shear. We report the indentation and shear behaviour of FC films with various thickness prepared by plasma enhanced polymerization. The measurements were performed by a microtribometer with a sphere-on-plane setup. A prescribed load was applied to a glass cantilever through which an atomically smooth Si sphere was in contact with a Si specimen covered with FC film. The normal load-displacement curves in loading and unloading were employed to study the indentation behaviour. Lateral force measured at various normal loads and strain rates were analyzed with contact models to study the shear properties. The topography of residual impression and the wear scars left by shear deformation were observed by a confocal scanning laser microscope and correlated with the indentation and shear measurements.

DS 24.25 Tue 15:00 P2

Parameter screening for the chemical vapour deposition of BN films in the system B-N-H-F — •Jens Matheis, Dimitrios Sapounas, and Achim Lunk — Institute for Plasma Research, University of Stuttgart, Pfaffenwaldring 31, 70569 Stuttgart, Germany

Cubic boron nitride (c-BN) is still an interesting material for protection layers as well as for applications in electronics. Up to now, a lot of different approaches where made to deposit c-BN layers in a μm range without internal stress. Mostly depositions were realized by plasma enhanced physical vapour deposition (PEPVD), using high energy ion bombardment. The stress can be reduced by lowering ion energy in com-bination with plasma enhanced chemical vapour deposition (PECVD). For the application of PECVD we have performed a parameter screening, varying the gas mixtures and the fluxes in the system B-N-H-F for BN-deposition.

Equilibrium state calculations were performed with different gas mixtures of the B-N-H-F-system. The programs CEA and KINTECUS were applied. Also the system Ar-BF_3-N_2-H_2 was calculated for comparison with data from literature. The results achieved in the system BF_3-N_2-H_2 show a good agreement with those obtained by EKVICALC.

For different gas mixtures we present and discuss the parameter ranges where deposition of BN is possible up to temperatures of 1500 K. We found that the relations of B to F as well F to H are crucial parameters for the BN formation. In a further step results will be presented of calculations outside of the thermodynamical equilibrium, including surface reactions and plasma stimulated reactions.

DS 24.26 Tue 15:00 P2

Substrate Temperature Control for Diamond Film Deposition — •Nicolas Wöhrl, Markus Degenhardt, and Volker Buck — Thin Film Technology Group, Dept. of Physics, University of Duisburg-Essen, Universitätsstr. 3-5, 45141 Essen, Germany

The substrate temperature is a critical process parameter for the deposition of diamond. A temperature above 500°C is needed for a reasonable deposition rate and should not extend 1300°C because above this temperature the films become more and more graphitic. Also the film properties are affected by the deposition temperature (e.g. morphology or residual stress).

Another important aspect of the diamond deposition is that the deposition rate of diamond films is scaling with the power used for the plasma. From this results that for high deposition rate the substrate must be cooled (For usual deposition rates mainly self-heating or even external heating are common). Therefore the control of the substrate temperature and an effective substrate cooling is crucial for the understanding of the deposition process and a high rate deposition of diamond.

Thus an aerosol water cooling of the substrate holder was build to meet the needs of the diamond deposition. The setup uses an IR-pyrometer to measure the substrate temperature.

The nanocrystalline diamond films shown in this work were deposited at different substrate temperatures from an $Ar/H_2/CH_4$ plasma in a MW-CVD plasma chamber. The performance of the aerosol water cooling and the influence of the substrate temperature on the film properties are shown.

DS 24.27 Tue 15:00 P2

Investigation of the normal force dependency of the static friction on the micro-scale — •Maksim Karniychuk[1], Thomas Chudoba[2], Volker Linss[2], and Frank Richter[1] — [1]Chemnitz University of Technology, Institute of Physics, 09107 Chemnitz, Germany — [2]ASMEC Advanced Surface Mechanics GmbH, Bautzner Landstr. 45, 01454 Radeberg, Germany

So far most of the tribological investigations are performed at load and length scales compatible with macroscopic devices. With recently developed techniques such as friction force microscopy (FFM) and different nano-tribological tests it is possible to study the friction on the nano- and micro-scale. In contrast to the investigation of kinetic friction by these new techniques the estimation of static friction is complicated. For the evaluation of the static friction on the micro-scale the lateral force must be applied to small surface areas with high lateral resolution, which can be achieved by a new Lateral Force Unit. Thus, the static friction force and, consequently, static friction coefficient can be determined.

In general the friction depends on adhesion and volume deformation. However, many other factors can influence the friction behavior on the micro-scale. For instance, the effect of the normal force on the kinetic friction was adequately studied on the micro-scale for many materials, for example, by FFM. Now the new device allows additionally investigating the influence of the normal force on the static friction behavior on the micro-scale.

DS 24.28 Tue 15:00 P2

Fabrication of ohmic Cr/Au contacts on top of cubic Boron Nitride thin films — •H. Yin, H.-G. Boyen, and P. Ziemann — Abteilung Festkörperphysik, Universität Ulm, 89069 Ulm

Cubic boron nitride (c-BN) is a superhard material with a hardness just second to diamond. In addition to many other attractive properties, c-BN also promises interesting applications as a high temperature electronics material due to its wide band gap (about 6eV), good thermal conductivity and good transmittance over a large spectral range from UV to visible. In this context, it is important to note that c-BN, unlike diamond films, can be doped both n- and p-type [1]. To arrive at such applications, however, high quality samples with a low level of defects are necessary. A significant step towards this goal has been achieved recently by the epitaxial growth of single phase c-BN films on top of diamond substrates applying ion beam-assisted deposition (IBAD) [2].

A further necessary intermediate step for electronic applications, however, is the preparation of corresponding ohmic electrical contacts on top of c-BN films. In the present work, Pulsed Laser Deposition (PLD) and Evaporation were tested to fabricate Cr/Au contacts through a mask on top of c-BN films. It turned out that evaporated films had to be additionally ion bombarded at room temperature with 300 keV Ar+ ions to guarantee mechanical stability whereas the PLD films were stable without further bombardment. The resulting I-V characteristics for both types of contacts exhibit the required ohmic behavior.

[1] O. Mishima et.al., Appl Phys Lett 53 (1988) 962 [2] XW Zhang et.al., Nature Materials 4 (2003) 312

DS 24.29 Tue 15:00 P2

Production and characterization of bandwidth- and phase-optimised La/B_4C-multilayer-mirrors for the reflection of ultra short X-ray pulses at 180eV — •Stefan Hendel, Ulrich Neuhäusler, Wiebke Hachmann, Ulf Kleineberg, and Ulrich Heinzmann — Faculty of Physics, University of Bielefeld, D-33615 Bielefeld

The applicability of reflective optical components for the soft X-ray region depends upon the existence of multilayer-optics. In particular the optimisation of multilayers for the soft X-ray spectral range call for new material combinations. For the photon energy range of about 180eV 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 3.5nm are produced by UHV Electron Beam Evaporation combined with Ion Polishing. The characterization of the layer purity is done by Sputter Auger Spectroscopy, whilst structural analysis is performed by X-ray Diffraction, Transmission Electron Microscopy and Ellipsometry. A further goal is the production of aperiodic (chirped) La/B_4C-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 first theoretical as well as experimental results.

DS 24.30 Tue 15:00 P2

Interfaces in Complex Organic Structures Investigated by Spectroscopic Ellipsometry — •Sascha Hermann, Ovidiu Gordan, Marion Friedrich, and Dietrich R.T. Zahn — Chemnitz University of Technology, Semiconductor Physics, D-09107 Chemnitz, Germany

Organic multilayers and mixed layers were prepared by organic molecular beam deposition in high vacuum on hydrogen passivated Silicon(111) substrates at room temperature. The structures consist either of N,N-Di(naphthalene-1-yl)-N,N‘-diphenyl-benzidine (α-NPD) and tris(8-hydroxyquinoline) aluminium (Alq_3) or 3,4,9,10-perylene-tetracarboxylic dianhydride (PTCDA) and copper phthalocyanine (CuPc). The samples were studied by spectroscopic ellipsometry in the range of 0.73 eV to 5 eV and infrared spectroscopy (IR). The optical response of the multilayers consisting of Alq_3 and α-NPD could be modelled using the isotropic dielectric functions of single layers assuming sharp interfaces. The PTCDA/CuPc multilayers were described using the anisotropic dielectric functions of the constituents including interface-mixing and surface roughness. The deviation between the best simulation and the experiment suggest an electronic interaction due to coupling between the π-orbitals of CuPc and PTCDA at the interfaces. This coupling influences the optical properties and the orientation of CuPc molecules.

DS 24.31 Tue 15:00 P2

Hf silicide growth on Si(100) studied by angle-scanned photoelectron diffraction — •A. de Siervo[1,2], S. Dreiner[1], C. Flüchter[1], D. Weier[1], M. Schürmann[1], U. Berges[1,3], M. F. Carazzolle[4], A. Pancotti[4], R. Landers[2,4], G. G. Kleiman[4], and C. Westphal[1,3] — [1]Experimentelle Physik 1 - Universität Dortmund, Otto-Hahn-Str. 4, 44227 Dortmund, Germany — [2]Laboratório Nacional de Luz Síncrotron, C.P. 6192, 13084-971 Campinas, SP, Brazil — [3]DELTA, Universität Dortmund, Maria-Goeppert-Mayer-Str. 2, 44227 Dortmund, Germany — [4]Instituto de Fisica, Universidade Estadual de Campinas, C.P. 6165, 13083-970 Campinas, SP, Brazil

Presently, alternative materials are extensively studied to replace the classical SiO_2 in new generation semiconductor devices. HfO_2 is one promising candidate. However, up to now, only very few studies on HfSi films are available and a structure determination is completely missing.

We present the results of a photoelectron diffraction study of Hf silicide growth on Si(100). The films were prepared in UHV by evaporating Hf to clean silicon surfaces and subsequent annealing. Full 2π angle scanned photoelectron diffraction patterns of Hf 4f and Si 2p signals were measured using conventional Mg K_α and synchrotron radiation. Diffraction patterns for low electron kinetic energies were obtained using photon energies of hν=180 eV of the undulator beamlines U250 and U55 of DELTA (Dortmund). At these energies, multiple scattering effects occur and a data analysis was only possible within a comprehensive multiple scattering calculation. We compare experimental and calculated results and present a structure model for the silicide films.

DS 24.32 Tue 15:00 P2

Application of white beam high energy X-ray diffraction to the analysis of near surface gradients — •Ingwer Denks, Manuela Klaus, and Christoph Genzel — Hahn-Meitner-Institut Berlin (c/o BESSY), Albert-Einstein-Straße 15, D-12489 Berlin

Energy dispersive (ED) diffraction using X-rays up to 100 keV or so is usually applied to the analysis of bulk properties of technical parts such as long range residual stress-, texture- or microstructure gradients. However, the small diffraction angles of some 5 to 10 deg used in high energy diffraction and the high photon flux provided by modern 3rd generation synchrotron radiation sources also allow depth resolved investigations of thin surface layers. So using very narrow slits in the primary and the diffracted beam, rhombohedral volume gauges of large aspect ratio and a small dimension less than 10 microns may be defined. In the contribution a new method is proposed, which is based on a fixed attachment of the slits to the sample system in such a way that the long side of the gauge is always parallel to the sample surface. It will be demonstrated that using such an experimental arrangement, high resolution depth profiling becomes possible even after sample tilt, i. e. for different orientations of the diffraction vector with respect to the sample system.

DS 24.33 Tue 15:00 P2

High-resolution elemental depth profiling of PIII&D deposited multilayer coatings by ion beam techniques combined with EFTEM — •Florian Schwarz[1,2], Jörg Lindner[1], Maik Häberlen[1], Götz Thorwarth[1,2], Claus Hammerl[2], Walter Assmann[3], and Bernd Stritzker[1] — [1]Institut für Physik, Universität Ausgburg, 86135 Augsburg, Germany — [2]AxynTeC Dünnschichttechnik GmbH, Am Mittleren Moos 48, 86167 Augsburg, Germany — [3]Sektion Physik der LMU München, Am Coulombwall 6, 85748 Garching, Germany

The emergence of multilayered and nanostructured coatings requires analysis methods capable of high spatial resolution as well as high depth range. While traditional ion beam analysis methods are capable of accurate, standards-free determination of sample composition, methods such as energy filtered transmission electron microscopy (EFTEM) offer the desired short-range resolution, yet are deficient in the quantitative assessment of the elemental contributions. We demonstrate the combination of IBA (ERDA, RBS) measurements with EFTEM data for analysis of two protective multilayer-type coatings grown by plasma immersion ion implantation and deposition (PIII&D) resulting in high resolution elemental depth profiles.

DS 24.34 Tue 15:00 P2

Preparation of TEM cross-sections and HRTEM structure determination of thin $La_{0.7}Sr_{0.3}MnO_3$ films — •Thomas Riedl, Thomas Gemming, and Klaus Wetzig — IFW Dresden, P.O. Box 270116, D-01171 Dresden, Germany

For the determination of lattice distortions of crystalline films by means of HRTEM well prepared TEM specimens are required. The quality of specimen preparation can be quantified in terms of amorphization, impurity content and specimen morphology. Conventional preparation using ion milling as well as the focussed ion beam H-bar technique have been applied to produce cross-sections of $La_{0.7}Sr_{0.3}MnO_3$ /$SrTiO_3$ samples interesting for magnetoelectronics. Thickness maps near the specimen rim indicate that under the applied parameters particularly the Bal-Tec RES ion mill produces large thin areas with small wedge angles and bending. Low-energy milling at 0.5keV reduces amorphized rims below 1nm leading to an enhanced atomic-column contrast in HRTEM images. The lattice distortions within the $La_{0.7}Sr_{0.3}MnO_3$ films have been studied by the analysis of HRTEM geometric phase [1]. As expected the lattice planes perpendicular to the interface are expanded whereas the parallel planes are compressed relative to the bulk [2].

[1] M. J. Hytch et al.: Ultramicr. 74 (1998) 131

[2] We acknowledge the DFG for financial support via FOR 520, project GE 1037/8.

DS 24.35 Tue 15:00 P2

Modeling asymetric polarization hysteresis of $BaTiO_3$-ZnO heterostructures — •V. M. Voora[1], N. Ashkenov[1], T. Hofmann[2], M. Lorenz[1], M. Grundmann[1], and M Schubert[2] — [1]Institut für Experimentelle Physik II, Universität Leipzig, Leipzig, Germany — [2]CMRA, University of Nebraska-Lincoln, Lincoln, USA

The spontaneous polarizations of appropriately oriented wurtzite and perovskite material layers cause bound charges at their interfaces. Whereas the wurtzite-type polarization is inherently tied to one distinct lattice direction, the spontaneous polarization can be reversed within the perovskite lattice upon application of external electric fields. We have successfully grown high-quality Pt-$BaTiO_3$-ZnO-Pt layer structures by Pulsed Laser Deposition on Si-substrate and investigated the structural, electrical, and optical properties of these structures. The asymetric polarization hysteresis of the Si-Pt-$BaTiO_3$-ZnO-Pt heterostructures show distinct fingerprints of a Schottky-type junction formed at the $BaTiO_3$/ZnO interface. For positive voltage direction the hysteresis is dominated by a clear reverse diode behavior, whereas for the negative voltage direction the clear switching behavior of $BaTiO_3$ is present. A quantitative model analysis of the electrical measurements is presented.

DS 24.36 Tue 15:00 P2

Coherent X-Ray Reflectivity at the Energy Dispersive EDR-Beamline at BESSY II — •Tobias Panzner[1], Gudrun Gleber[1], Tushar Sant[1], Ivan Vartanyants[2], and Ullrich Pietsch[1] — [1]Universität Siegen, Fachbereich 7, Festkörperphysik, Emmy-Noether-Campus, Walter-Flex-Str. 3, 57068 Siegen — [2]DESY Hamburg

3rd generation storage rings provides partly coherent radiation allowing for new kind of x-ray experiments. Adapting knowledge and techniques from the photon correlation spectroscopy with visible light (PCS) many successful experiments are published where sample became under investigation which are opaque in PCS. The advantage of coherent x-ray experiments is the reconstruction of surfaces on micrometer to nanometer length scale (static speckle experiments) or the observation of dynamic processes (XPCS) at surfaces and interfaces on the same length scale. One major drawback of standard x-ray experiments is that only intensities can be measured. In case of coherent x-ray scattering this problem can be overcome by reconstruction of the missing phase information by the so-called phase retrieval procedure. In our poster we show this procedure for energy-dispersive coherent scattering where the development of phase is considered along the whole beam passage from the incoming pinhole through the scattering by sample up to the detector. Taking the known phase information of the pinhole into account we are able to reconstruct the true surface of the illuminated sample area more precisely.

DS 24.37 Tue 15:00 P2

FT-IR studies of Ag/MgO(001) — •Fanzhen Meng, Daniel Seibel, Gerhard Fahsold, and Annemarie Pucci — Kirchhoff-institut für Physik, Heidelberg University, Im Neuenheimer Feld 227, D-69120 Heidelberg, Germany

We present the IRRS (Infrared reflection spectra) of Ag films measured during their growth on MgO(001) at room temperature, at 100 K, and at 50 K. We get a reflectance minimum at a certain thickness. This thickness is comparable to the percolation threshold that we know from our previous IR transmittance measurements [1]. Beyond the percolation threshold, the IRRS of room temperature prepared films show structures quite different to those grown at low temperature. Also, we will show the effect of gas exposure during metal deposition on IR spectra and film morphology at room temperature. For the Ag/MgO(001) system, CO does not show an effect, different to Cu/MgO(001) [2]. However, we detected that hydrocarbon exposure leads to enhanced film roughness. From surface enhanced IR absorption (SEIRA) of adsorbates we get additional information on film morphology.

[1] F. Meng, G. Fahsold and A. Pucci, Phys. Stat. sol.(c), accepted.

[2] M. Lust, A. Priebe, G. Fahsold and A. Pucci, Surf. Interface Anal.33, 487 (2002).

DS 24.38 Tue 15:00 P2

Effect of film thickness on the microstructures of Indium - Indium oxide composite films — •Deniz Deger and Kemal Ulutas — Istanbul Univ., Science Faculty, Physics

Pure indium metal thermally evaporated in the presence of oxygen atmosphere, with partial pressure of $5x10^{-4}$ Torr, onto glass substrates and onto C-Cu grid at room temperature. The structural characteristics of these optically transparent and electrically conducting thin films were investigated using XRD and TEM techniques and the results are discussed on the base of the differences in their morphologies and thicknesses. Cubic In_2O_3 and tetragonal In phases, with crystal structures and lattice parameters as reported in the literature, have been identified in the thinnest film having 1000 Å thickness. The tendency for amorphization of the cubic and tetragonal phases becomes evident as the film thickness increases.

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DS 24.39 Tue 15:00 P2

Direct Observation of Intermediate Phases of Pyrolytic Carbon by Atomic Force Microscopy — •Andreas Pfrang[1], Yong-Zhong Wan[1], and Thomas Schimmel[1,2] — [1]Institute of Applied Physics, University of Karlsruhe, D-76128 Karlsruhe, Germany — [2]Institute of Nanotechnology, Forschungszentrum Karlsruhe, D-76021 Karlsruhe, Germany

Although it is technologically highly relevant, the mechanism of pyrolytic carbon deposition is not yet fully understood. Especially the role and even the existence of intermediate phases of carbon during deposition are not clear. In our experiments, islands and layers of pyrolytic carbon were deposited on planar substrates in a hot-wall reactor from methane / argon mixtures. Combined scanning force techniques were applied to reveal two types of islands by different chemical contrast. This observation can be interpreted in terms of an intermediate phase of pyrolytic carbon [1]: for deposition in a regime where the nucleation mechanism dominates, an intermediate phase of pyrolytic carbon was predicted which is expected to have deviating mechanical properties in good agreement with our results of island removal experiments carried out using atomic force microscopy.

Moreover, on layers deposited at sufficiently high methane pressures where adsorption saturation is reached, additional carbon structures exhibiting different chemical contrast were found. This is further experimental evidence for the existence of an intermediate phase of carbon postulated for deposition in the nucleation mechanism.

[1] Z.J. Hu, K.J. Hüttinger. Carbon 40 (2002), 617-636

DS 24.40 Tue 15:00 P2

FTIR-ATR study of the interface between Al_2O_3 and H-terminated SiC(0001) and Si(111) — •F. Speck, K.Y. Gao, K. Emtsev, Th. Seyller, and L. Ley — Lehrstuhl für Technische Physik, Universität Erlangen-Nürnberg, Erwin-Rommel-Str. 1, D-91058 Erlangen, Germany

Aluminum oxide (Al_2O_3) is an insulator which can be regarded as an alternative to thermally grown SiO_2 as gate dielectric for MOSFETs on Si as well as on SiC. We have studied the composition of the interface between the dielectric Al_2O_3 and the semiconductors Si and SiC. Al_2O_3 films were grown by atomic layer deposition (ALD) on hydrogen-terminated SiC(0001) and Si(111) substrates. Surface hydrogenation of SiC(0001) was performed by annealing in ultrapure hydrogen. On Si(111) a wet-chemical treatment by etching in NH_4F was employed. The interfaces were investigated for Si-H bonds by Fourier-transform infrared attenuated total reflection spectroscopy (FTIR-ATR). The spectra show that on both SiC(0001) and Si(111) Si-H entities are present at the interface after the ALD process. The characteristic absorption line of the Si-H stretching vibration is broadened and red-shifted as compared to Si-H modes on the hydrogenated substrates. Shift and broadening are probably due to electrostatic interactions at the interface. The presence of Si-H bonds suggests that substrate atoms not connected to the aluminum oxide remain saturated by hydrogen atoms.

DS 24.41 Tue 15:00 P2

Ultra thin Aluminium oxide films on silicon — •Mandana Roodbari Sh. and Ali Bahari — Physics Department, Mazandran University, Iran

Ultra thin aluminium oxide films, have been identified as potential candidates to replace conventional silicon oxide gate dielectrics in current and future CMOS. Because a shrinking of the silicon oxide thickness with one atomic layer for the next generation will lead to a couple of orders of magnitude increase in tunneling current. Another critical issue for future generations is gate oxide degradation due to boron penetration into the oxide from the poly-silicon gate electrode. We have demonstrated a number of new processes to grow ultra thin aluminium oxides. These sudies have demonstrated a number of new processes to grow ultra thin aluminium oxides.

Two step processes have been employed including evaporation of aluminium to less than monolayer coverage followed by oxygen oxposure. For these investigations of nano-properties and atomic growth processes, the availability of synchrotron radiation with high quality and stability, as met at ASTRID, Aarhus in Denmark, has been important.

Therefore, the present method can be used to deposit uniform aluminium oxide layers of the relevant effective thickness for coming generations of devices directly on silicon surfaces, with atomically sharp interfaces.

DS 24.42 Tue 15:00 P2

Abscheidung von siliziumhaltigen Schichten auf Mikroteilchen in dielektrisch behinderten Plasmen unter Atmosphärendruck — •Marcel Hähnel, Volker Brüser, and Holger Kersten — INP Greifswald, F.-L.-Jahn Straße 19, 17489 Greifswald

Die vorliegende Studie befaßt sich mit der Abscheidung von homogenen und geschlossenen SiO_2-haltigen Schichten auf Mikroteilchen. Diese Schichten wurden aus Hexamethyldisiloxan (HMDSO) und Tetraethylorthosilicat (TEOS) unter Beimischung verschiedener Gaszusammensetzungen deponiert. Die Untersuchungen zur Abscheidung solcher SiO_2-haltigen Schichten erfolgte auf Kaliumbromidpulver in der Größenordnung von 10 bis 80 Mikrometer. Für die Beschichtung wurde eine dielektrisch behinderte Oberflächenentladung verwendet, die durch Modifikationen auch für eine kontinuierliche Arbeitsweise geeignet ist. Die Entladung wurde gepulst mit Spitzenspannungen von 14 kV bei einer Pulswiederholrate von 10 kHz betrieben. Als Spannungsquelle diente ein Fourier-Synthese Impulsgenerator mit einer Ausgangskapazität von 200 pF.

Die Bewertung der Schichten erfolgte durch Oberflächenanalytik (FTIR, REM), sowie makroskopischer Tests zur Bestimmung der physikalisch-chemischen Eigenschaften.

DS 24.43 Tue 15:00 P2

Electrophysical properties of TiN thin films deposited by plasma treatment — •Elena Shcherbakova — Minsk, Belarus

In this work the dependence of resistivity of titanium nitrides thin films upon changes in their structure and phase composition as a result of processing with hydronitrogen plasma was found. By means of transmission-electron microscopy and electron diffractometry regularity of structural and phase transformations in titanium thin films irradiated with plasma of arc discharge were investigated. Conditions of processing by plasma for formation of titanium nitrides thin films with resistivity 50 μOhm/cm were determined.

The results of studies show that the titanium films obtained have resistivity ≈110 μOhm/cm. This films polycrystalline and fine-grained, with the average grain size of 5-10 nm. When the films is exposed to hydronitrogen plasma at 500 °C, TiN and Ti_2N are formed and resistivity is increased to 210 μOhm/cm. As treatment temperature is increased to 600°C, the nitride phase having a small amount of nitrogen disappears, and a film of golden colour, consisting entirely of TiN, is formed. Further increasing of temperature to 750°C does not change phase composition, but the average grain size is increased to ≈120 nm. At temperatures up 600 to 750°C titanium nitride films had a small resistivity of 50-60 μOhm/cm.

DS 24.44 Tue 15:00 P2

Structural evolution in reactively sputtered copper nitride films — •F. Uslu[1], M. Luysberg[2], K. Sarakinos[1], P. Karimi[1], and M. Wuttig[1] — [1]I.Physikalisches Institut, RWTH Aachen, 52056 Aachen — [2]IFF, Forschungszentrum Jülich, 52425 Jülich

Early transition metal nitrides such as TiN or ZrN are well known for their applications, which include hard coatings due to their high hardness and high melting temperatures. Much less is known about the physical properties of late transition metal nitrides such as copper-nitride. Reactive dc magnetron sputtering has been applied to prepare copper-nitride films on glass and silicon substrates as well. To elucidate the microstructural features of copper nitride films several methods such as X-ray diffraction, grazing incidence geometry and X-ray reflectometry have been employed. In addition transmission electron microscopy has been utilised to obtain a thorough understanding of the microstructural evolution in copper-nitride films. To this end specimens deposited at two different nitrogen flow rates of 12 and 50 sccm N_2 respectively, were analysed. The x-ray investigations reveal that the (111) and (200) grain orientations are stronger than the other ones, where the (111) orientation is dominant. It was possible to decrease this (111) preferred orientation and increase of the (200) orientation by increasing the sputtering current. This is attributed to an enhanced incident ion flux and hence to a bombardment with nitrogen ions. A further effect of this bombardment is reflected in the mechanical properties, where the films reveal compressive stress. The enhanced bombardment leads to an increase of the cell size with increasing nitrogen flow rate.

DS 24.45 Tue 15:00 P2

Self-organised pattern formation upon femtosecond laser ablation — •Olga Varlamova[1,2], Florenta Costache[1,2], Markus Ratzke[1,2], and Jürgen Reif[1,2] — [1]LS Experimentalphysik II, BTU Cottbus, Karl-Wachsmann-Allee 1, 03046 Cottbus — [2]IHP/BTU JointLab, Karl-Wachsmann-Allee 1, 03046 Cottbus

Upon multi-shot femtosecond laser ablation from different materials, self-organised regular patterns are observed at the crater bottom. By irradiation with linearly polarised light, it has been shown that long periodic ripples with many bifurcations develop, the orientation of which is determined by the polarisation direction, though the fundamental nature of this correlation is not yet known. To investigate this phenomenon closer, we performed corresponding experiments using circularly and elliptically polarised light. Surface morphology investigation reveals that, again, a variety of self-organised patterns is obtained, from arrays of nanoparticles to bifurcating longer lines. Experiments with laser beams of elliptical polarisation have shown that ripples' orientation is sensitive to the major axe of the polarization ellipse. However, for circularly polarized light the orientation of these structures is random. Furthermore, electrical measurements done with a Scanning-Probe Microscope on the ablated area reveal the existence of a spatial variation in the electric field response correlated with the patterns' modulation on the crater bottom.

DS 24.46 Tue 15:00 P2

Femtosecond Laser Ionization Mass Spectrometry for Analysis of Multi-layered Structures — •Lei Zhu[1,2], Florenta Costache[1,2], Markus Ratzke[1,2], and Jürgen Reif[1,2] — [1]LS Experimentalphysik Brandenburgische Technische Universität Cottbus, Karl-Wachsmann-Allee, 03044, Cottbus — [2]IHP/BTU JointLab Cottbus, Karl-Wachsmann-Allee, 03044, Cottbus

Using a femtosecond laser as the ionization source, a Time-of-Flight Laser Ionization Mass Spectrometer (ToF-LIMS) is explored with respect to its potential for elemental analysis and depth profiling of multi-layered samples, an alternative to the classical SIMS. For this investigation, we used a structure of type Metal-Oxide-Semiconductor (MOS): a layer of high-k dielectric of Pr_6O_11 grown by Pulsed Laser Deposition (PLD) on Si (100), covered by an aluminum contact layer.
High lateral and depth resolution could be attained by using small laser spot sizes provided by laser fluences below the ablation threshold for a single pulse. The characteristics of the emitted positive ions give valuable information on the layers quality such as composition, stoichiometry, interface constituents, oxidation and aging. By simultaneously monitoring the layers' ion product yields over a large number of pulses, anti-correlated ion signals revealing sharp interfaces were identified.
Furthermore, we investigated the morphology of the resulting craters by Atom Force Microscopy. The results indicate that by using ToF-LIMS a depth resolution in the nanometer range could be reached.

DS 24.47 Tue 15:00 P2

Structural and magnetic investigations on Mn-implanted beta-Iron-Disilicide — •Frank Stromberg[1], Helfried Reuther[2], and Werner Keune[1] — [1]Angewandte Physik, Universität Duisburg-Essen, 47048 Duisburg, Germany — [2]Forschungszentrum Rossendorf, 01314 Dresden, Germany

100 nm thick epitaxial beta-Iron-Disilicide films were grown on Si(100) substrates by MBE and ex-situ implanted with Mn-ions at energies of 90 and 150keV.

The doses varied from 1E16 to 1E17. X-Ray and Mössbauer spectroscopy confirmed the amorphization of the implanted films.

Hall measurements exhibit n-type behavior of the implanted samples whereas literature states that they should be p-type conducting.

The conductivity of the implanted samples is strongly enhanced but for the sample with the highest dose it drops.

Anomalous Hall effect and Magnetoresistance measurements were performed but a conclusive hint pointing at magnetic effects is only possible after SQUID measurements which are currently performed.

DS 24.48 Tue 15:00 P2

The New Neutron Reflectometer-NeRo — •Danica Solina, Dieter Lott, Ursula Tietze, Oliver Frank, Vincent Leiner, and Andreas Schreyer — GKSS Forschungszentrum GmbH, Max-Planck Str. 1; D-21502 Geesthacht, Germany

2005 saw the opening of the new NEutron ReflectOmeter (NeRo) at the GKSS research centre in Geesthacht, Germany for the investigation of magnetic and non-magnetic systems as well as soft matter nanostructures.

NeRo operates with a monochromatic beam of neutrons of wavelength 0.433 nm with a resolution better than 2%. An angular range of $20° < 2\theta < 100°$ allows for both reflectometry and high angle diffraction measurements to be made on NeRo. NeRo has both a position sensitive detector and a pencil detector installed for flexibility when making specular and diffuse measurements.

NeRo has been designed to accommodate heavy sample environments such as cryo-furnaces and various kinds of magnets. Polarization analysis is available for the investigation of magnetic nano-structures. A super mirror stack with a wide angular acceptance range will be available in 2006 for time efficient measurements of magnetic diffuse reflectivity.

Further information and proposal forms can be obtained online at http//:genf.gkss.de.

DS 24.49 Tue 15:00 P2

Effect of the Heat Treatment on the Structural and Optical Characteristics of Polycrystalline ZnTe Thin Films — •Rusu Gheorghe and Prepelita Petronela — Faculty of Physics Al. I. Cuza University, Iassy, R-700506, Romania

ZnTe thin films have been intensively studied in the last years. ZnTe thin films (d =230 - 2150 nm) were deposited onto glass substrates by the quasi-closed volume technique under vacuum. It was established that the films with stable structure can be obtained if they, after deposition, are subjected to a heat treatment. The structure analysis of the films was performed by X-ray diffraction (XRD) technique and atomic force microscopy (AFM). The structural investigations performed by means of XRD technique showed that the films have a polycrystalline and blende (cubic) structure. They are highly oriented with the (111) planes parallel to the substrate. AFM images showed that have a grain like surface morphology. The values of the optical parameters (refractive index and absorption coefficient) were determined from transmission spectra (in the spectral range 500-1400nm) using Swanepoels method. The effect of heat treatment on the shape of the transmission and absorption spectra is studied for samples with different thickness. Optical energy gap, calculated from the absorption spectra was in the range 1.9eV-2.4eV.

DS 24.50 Tue 15:00 P2

Magnetic and transport properties of electrodeposited Fe-Pt thin films — •Violeta Georgescu[1], Cristina Sirbu[1], and Mihaela Daub[2] — [1]Faculty of Physics, Al. I. Cuza University, Iasi, Romania — [2]Max-Planck-Institute for Microstructure Physics, Halle, Germany

We present a comparative investigation of the surface, structural, magnetic and electric properties of electrodeposited Fe-Pt films in a composition range close to (L12) $FePt_3$ ordered phase. The system of Fe-Pt was chosen because of the "competition" between ferro- and antiferromagnetism in these alloys, which is favouring the GMR effect. Only a relatively few studies of the magnetic properties of electrodeposited Fe-Pt films exist up to now. The Fe_xPt_{1-x} films, with x=(30-38)% and thickness of 250-300 nm, were electrochemically deposited on Cu (100) textured foils. XRD and AFM showed that the electrodeposited films were nanocrystalline alloys in a disordered or a partially ordered chemical state. By using a torque magnetometer in fields up to 300 kA/m at room temperature, the easy magnetization direction was observed to be perpendicular to the film plane. The magnetoresistance was measured by applying the current perpendicular to the plan (CPP) and the magnetic field perpendicular or parallel to the film plane. For films with x of around 30%, the magnetoresistance was (7.8-11.8)% in CPP geometry, indicating the possibility of interesting technological applications.

DS 24.51 Tue 15:00 P2

Reflectance Anisotropy Spectroscopy in the VUV range for the characterisation of thin organic layer — •Philipp Myrach[1,2], Christoph Cobet[2], Regina Passmann[2,1], Norbert Esser[2], and Wolfgang Richter[1] — [1]Technische Universität Berlin, Inst. f. Festkörperphysik, PN6-1, Hardenbergstr. 36, 10623 Berlin — [2]Institut for Analytical Science, Albert Einstein Str. 9, D-12489 Berlin

In the last couple of years organic-based electronics becomes increasingly important. So organic functionalization is relevant to develop new semiconductor devices. To investigate the molecules attachment and the formation of the thin layers the method of Refletance Anisotropy Spectroscopy(RAS) should be very useful. This method allows to give an fast, non-destructive and in-situ characterisation of the optical and electronic properties.

Optical characterisation of semiconductors is usually done in the visible-UV spectral range. But ab-initio calculations show that the characteristic HOMO-LUMO transitions of many relevant organic molecules and transitions between substrate and organic layer stats are located in the VUV range(above 5eV). Due to this predictions, we have extented the RAS to the VUV spectral range.

When using an optically isotropic substrate material, RAS technique is very sensitive to surfaces or interfaces. Thus RAS measures the difference of reflectance between the thin film optical axies. Therefore its possible to study organic layers with an single layer sensitivity.

DS 24.52 Tue 15:00 P2

Electrochemical Growth and Properties of Thin Polyaniline Films on p-Si (111) and Au (111): A Comparative Study — •Lidiya Komsiyska[1], Georgi Staikov[1], and Vessela Tsakova[2] — [1]Institute of Thin Films and Interfaces (ISG3), and cni-Centre of Nanoelectronic Systems for Information Technology, Research Centre Jülich, 52425 Jülich, Germany — [2]Institute of Physical Chemistry, Bulgarian Academy of Sciences, 1113 Sofia, Bulgaria

Due to their electronic properties and stability, polyaniline (PANI) layers are attractive for application in various micro- and nano-devices for electronics and sensorics. In this contribution we report a comparative study on electrodeposition of thin PANI layers on single crystal

p-Si(111) and Au(111) substrates. The mechanism of formation and the properties of electrodeposited polymer films are investigated by means of transient measurements, cyclic voltammetry, electrochemical impedance spectroscopy (EIS) and atomic force microscopy (AFM). The analysis of potentiostatic current transients obtained on both substrates show different growth mechanisms in the initial deposition stages. PANI layers on Au(111) are characterized by a smoother surface, compactness and higher electrochemical stability. Cyclic voltammetric and impedance measurements show that the redox switching of PANI layers is influenced strongly by the electronic band structure of the substrate. The possibility for an additional modification of the PANI layers by electrochemical deposition of Au nanoparticles is also demonstrated.

DS 24.53 Tue 15:00 P2

Effect of the Base Pressure on OMBD grown BCP Layers Studied by Spectroscopic Ellipsometry — •Daniel Lehmann and Dietrich R. T. Zahn — Chemnitz University of Technology, Semiconductor Physics, D-09107 Chemnitz, Germany

Bathocuproine (BCP) layers are used in organic opto-electronic devices such as organic light emitting devices (OLEDs) and organic photovoltaic (OPV) solar cells as electron conducting, exciton blocking layers enhancing the device efficiency. The layers in this study were grown using Organic Molecular Beam Deposition (OMBD) on cleaned silicon substrates with a layer of natural silicon oxide. Two layers with different thicknesses (10 nm and 100 nm) were prepared for each base pressure step. After preparation they were studied *ex situ* with Variable Angle Spectroscopic Ellipsometry (VASE) in the energy range from 0.73 eV to 5.00 eV and the dielectric functions were determined. The results show that the base pressure, ranging from 10^{-5} mbar to 10^{-8} mbar has a strong impact on the dielectric function and therefore also on light absorption and refraction.

DS 24.54 Tue 15:00 P2

Temperature Controlled Deposition of Thin Plasma Polymer Films Containing Hydroxyl Groups — •Jan Schäfer and Jürgen Meichsner — Institute of Physics, Ernst-Moritz-Arndt-University of Greifswald, Domstraße 10a, D-17489 Greifswald

Thin functional plasma polymer films from ethylene glycol (EG) are deposited in the RF plasma reactor Nevada. The films are characterized by a high content of hydroxyl functional groups.

A mixture of EG vapour and argon was used as a reactive process gas system. By the IR Reflection Absorption Spectroscopy (IRRAS) of the temperature tuneable surface we characterised the (p,T)- phase diagram of the mixture. Following we localized that area of the diagram where an irreversible reaction process between the plasma and the EG liquid condensate results in the solid polymer film.

The in situ IRRAS was applied for an analysis of changes in the molecular structure of the films. Depending on the position in the phase diagram the molecular composition of the films varied, in particular the proportion between hydroxyl and carbonyl groups. This is in correlation with the temperature behaviour of the film during the plasma surface interaction.

The nature of the Poly(EG)-like films by means of the new deposition method is discussed concerning biochemical applications.

DS 24.55 Tue 15:00 P2

Growth Studies on Organic Charge Transfer Materials: $(ET)_2Cu(NCS)_2$ — •Kerstin Keller, Florian Roth, Yoon-Jeong Lee, and Michael Huth — University Frankfurt, Max-von-Laue-Str. 1, 60438 Frankfurt am Main

The growth of organic thin films of Pentacene and BEDT-TTF (ET) prepared by organic molecular beam deposition (OMBD) is studied and the evaporation process is modeled by Monte Carlo simulations. By co-evaporation of ET and $Cu(NCS)_2$ the formation of the charge transfer salt $(ET)_2Cu(NCS)_2$ is investigated, where the superconducting kappa-phase is of special interest. The thin films are characterized by x-ray diffraction. With in-situ shadow mask technique different functional device structures such as field effect transistors (FET) and tunneling contacts can be prepared. This enables us to investigate the electronic properties with low temperature measurements.

DS 24.56 Tue 15:00 P2

Surface morphology of solid supported phospholipid membranes on self-organized, nanostructured semiconductor substrates — •Gerald Trummer, Christian Hofer, Gregor Hlawacek, and Christian Teichert — Institute of Physics, University of Leoben, A-8700 Leoben, Austria

Self-organization effects during heteroepitaxy or ion bombardment of semiconductors frequently result in large area nanostructured substrates, which can be used as templates for further deposition of thin films. [1]

Here, we utilize nanofaceted SiGe films as well as ion bombarded Si and SiGe samples as templates for phospholipid (POPE) membranes. Atomic-force microscopy is applied to study the resulting film morphology as a function of deposition techniques and template geometry.

Areas of low lipid coverage show typical terrace structures. The height of single bilayers varies between 4 nm and 7 nm depending on hydration. Phase imaging allows identification of the boundary layer between substrate and lipid. For certain templates, the substrate morphology controls the film roughness and/or the lateral shape of the bilayer islands.

[1] C. Teichert, Appl. Phys. A 76, 653 (2003)

DS 24.57 Tue 15:00 P2

Optical and structural properties of perylene films — •Stephan Kremers, Phenwisa Niyamakom, Maryam Beigmohamadi, Azadeh Farahzadi, Thomas Michely, and Matthias Wuttig — I. Institute of Physics (IA), RWTH Aachen University, 52056 Aachen, Germany

Highly symmetric organic molecules such as perylene tend to grow crystalline which give rise to high carrier mobility. This property makes them feasible for low-cost electronic device. We have therefore investigated the properties of thin films of the perylene deposited on various substrates such as silicon, glass and gold with different deposition rates and film thicknesses. Subsequently their structural properties were measured employing both AFM to determine the film roughness and surface morphology as well as XRD to determine their micro strain, texture and grain size. Finally their optical properties were determined with ellipsometry and UV-VIS spectroscopy. The structure investigation shows that highly textured films with specific defects form above a critical thickness. This has a profound impact on the growth morphology. The combination of AFM and XRD enables the identification of the defects. The highly textured films show a pronounced optical anisotropy. Efforts to simulate this anisotropy are presented.

DS 24.58 Tue 15:00 P2

Perfluorinated and nonfluorinated Vanadyle Phthalocyanine on gold - interface properties of two dipolar materials — •Indro Biswas[1], Heiko Peisert[1], Kanai Kaname[2], Nakano Tomohito[2], Seki Kazuhiko[2], Danilo Dini[3], Michael Hanack[3], and Thomas Chassé[1] — [1]Institut für Physikalische und Theoretische Chemie, Universität Tübingen, Auf der Morgenstelle 8, 72076 Tübingen, Germany — [2]Nagoya University, Graduate School of Science, Division of Materials Science, Furo-cho, Chikusa-ku, Nagoya 464-8602, Japan — [3]Institut für Organische Chemie, Universität Tübingen, Auf der Morgenstelle 18, 72076 Tübingen, Germany

The interface properties of vanadyle phthalocyanine (PcVO) and its perfluorinated derivative (F_{16}PcVO) on gold are compared to the corresponding copper phthalocyanines (PcCu, F_{16}PcCu), using photoemission spectroscopy and Kelvin probe measurements. Similarly to F_{16}PcCu, the ionisation potential of F_{16}PcVO is more than 1 eV higher than of the unsubstituted material, and thus a downward (PcVO) or upward (F_{16}PcVO) energy shift is observed. Due to their nonplanar molecular shape both vanadyle phthalocyanines have permanent dipoles. The molecular dipole moment of F_{16}PcVO is influenced by the high electronegativity of the substituting fluorine atoms. For the understanding of energetic shifts at the metal-organic interface the orientation of molecular dipoles is crucial. Different growth modes and π-π interactions are discussed.

DS 24.59 Tue 15:00 P2

Plasma stabilization and increase of the deposition rate during reactive sputtering of metal oxides — •Daniel Severin[1], Oliver Kappertz[2], Tomas Nyberg[2], Sören Berg[2], Andreas Pflug[3], Michael Siemers[3], and Matthias Wuttig[1] — [1]I. Institute of Physics (1A), Aachen University, Germany — [2]Solid State Electronics Division, Uppsala University, Sweden — [3]Fraunhofer IST, Braunschweig, Germany

Reactive sputtering is an attractive technique for the deposition of metal oxides. One of its main drawbacks, however, is the hysteresis and process instability encountered in the transition from the metallic to the compound mode, where films can be deposited most rapidly with desirable properties. Here we present a method to stabilize the undesirable abrupt transition between metallic and compound mode. The addition of nitrogen in the plasma gas leads to supplanting of oxygen by nitrogen on the target's surface and coverage with the corresponding nitride. Due to the lower reactivity of the nitride compared to the oxide and a smaller effective target area the hysteresis vanishes. In addition a higher deposition rate is achieved since the sputtering rates of the nitrides are generally higher than those of the corresponding oxides. The observed behaviour can be qualitatively explained and theoretically predicted using an extention of Berg's model to two different reactive gases. Although the nitrogen addition leads to pronounced changes of the plasma, the incorporation of nitrogen atoms in the growing film is very small as predicted by theory.

DS 24.60 Tue 15:00 P2

Reaktives Plasmajet-Ätzen - Wechselwirkungen mit Si-Oberflächen — •Thomas Arnold und Axel Schindler — IOM e.V., Permoserstr. 15, 04318 Leipzig

Lokale Trockenätzverfahren auf der Basis reaktiver Plasmajets stellen eine vielversprechende Technologie für die Bearbeitung und Formgebung von Oberflächen aus siliziumhaltigen Materialien dar.

Die Untersuchungen zum plasmachemischen Hochrateätzen mit einem nichtthermischen $Ar/SF_6/O_2$-Plasmajet mit Mikrowellenanregung konzentrieren sich auf die lokale Verteilung von Teilchenflüsse der ätzaktiven Spezies (Fluoratome) sowie auf die komplexe SF_6-Chemie im Plasmajet. Desweiteren werden die aus der Plasmachemie folgenden Effekte im Wechselwirkungsbereich zwischen Si-Substratoberfläche und Plasmajet untersucht. Die Reaultate zeigen, dass trotz der komplizierten Abhängigkeit der Teilchenflüsse von den Prozessparametern reproduzierbare Ätzergebnisse möglich sind.

DS 24.61 Tue 15:00 P2

Development of Corrosion Resistant Mg-Alloys using Ion Beam Sputter Technologies — •Yvonne Bohne[1], Stephan Mändl[1], Bernd Rauschenbach[1], Carsten Blawert[2], and Wolfgang Dietzel[2] — [1]Leibniz-Institut für Oberflächenmodifizierung, Leipzig, Germany — [2]Center for Magnesium Technology, GKSS Forschungszentrum Geesthacht GmbH, Germany

Magnesium alloys offer a high potential for use as lightweight structural material in transport applications as automotive and aerospace. However, magnesium is a reactive metal, therefore corrosion protection is an issue of great importance. By ion beam sputtering (IBS) solid solution magnesium alloys can be deposited on various substrates such as commercial magnesium alloys or Si. This employed method has decisive advantages, insertion of alloying elements above the equilibrium solubility is are possible and phases far away from the thermodynamic equilibrium can be obtained, both with improved corrosion resistance. Binary (Mg-Al, Mg-Ti and Mg-Si) and ternary alloys were deposited in this experiment. For characterization, the layers were investigated by RBS, ERDA and SIMS to determine the chemical composition and by REM and XRD to study the microstructure and phase composition. For the new unconventional alloys based on Mg-Ti and Mg-Si (high Si concentrations) the corrosion properties were studied by potentiodynamic polarization, polarization resistance and electrochemical impedance techniques. For the Mg-Al system effects of the microstructure on the corrosion behaviour was studied by comparing as cast material and coatings. (Supported by the DFG in the course of the priority program 1168)

DS 24.62 Tue 15:00 P2

Mechanical Properties of CoCr Alloys After Nitrogen PlasmaImmersion Ion Implantation — •Inga-Maria Eichentopf, Antje Lehmann, Jürgen W. Gerlach, and Stephan Mändl — Leibniz-Institut für Oberflächenmodifizierung, Leipzig, Germany

Nitrogen implantation at low energies, high fluences and elevated temperatures into CoCr alloys, suitable for medical applications, leads to the formation of modified surface layers by a combination of ion implantation and thermally activated diffusion. After implantation at 25 kV acceleration voltage at temperatures of 300 - 600 °C into HS188 and L605, modified surface layers with a thickness between 300 and 5000 nm were found. However, a strong apparent reduction of diffusivity, respective, the activation energy for diffusion was found between 500 and 600 °C. A detailed investigation of the phase formation by X-ray diffraction and metallographic cross-section revealed a changing phase composition with CrN and Cr_2N dominating at higher temperatures, thus the assumption of a single diffusion process is misleading. The hardness of the surface layer increased from about 300 HV by a factor of 3 – 5.

DS 24.63 Tue 15:00 P2

Correlation between Plasma Homogeneity and Lateral Ion Flux Distribution in Plasma Immersion Ion Implantation — •Johanna Lutz, Oliver Otto, and Stephan Mändl — Leibniz-Institut für Oberflächenmodifizierung, Leipzig, Germany

Plasma immersion ion implantation (PIII) is a modern technology for surface modification allowing the simultaneous implantation into complex shaped objects, thus facilitating the formation of functional surfaces for several technologically important areas like biomedicine, automotive and textile industry. However, the local ion flux density, which cannot be measured directly, strongly depends not only on the plasma parameters but additionally on the sample geometry and the applied pulse voltage. In this experiment, the variation of the lateral ion flux density was studied using circular samples ranging from 60 to 150 mm, consisting of thin SiO_2 on Si. Argon as well as nitrogen plasma was used with acceleration voltages between 5 and 10 kV. The amount of material removed by the impinging ions was determined by spectroscopic ellipsometry. For comparison, the ion flux density was calculated from the plasma sheath dynamics using plasma densities and electron temperatures measured with a Langmuir probe. Good agreement between both values was observed using sputter yields from SRIM calculations. Next to a strong correlation between plasma density variations and the flux distribution, additional influences of the sample size and the plasma sheath width were found.

DS 24.64 Tue 15:00 P2

Grain Size as Proxy for Intragrain Nitrogen Diffusion in Ion Nitrided Austenitic Stainless Steel — •Darina Manova, Dietmar Hirsch, Stephan Mändl, Horst Neumann, and Bernd Rauschenbach — Leibniz-Institut für Oberflächenmodifizierung, Leipzig, Germany

Nitrogen insertion at low energies and temperatures between 350 and 380 °C in austenitic stainless steel results in the formation of thick modified layers with outstanding mechanical properties and excellent corrosion resistance. The main characteristics of these layers are an anisotropic lattice expansion a concentration dependent diffusion rate. In this investigation nitrogen plasma immersion ion implantation was performed into austenitic stainless steel X5CrNi18.10 (DIN 1.4301) for different microstructures of the base material. This was achieved by annealing the as-received material at different temperatures ranging from 900 to 1200 °C. Results from investigations of metallographic cross sections are presented together with nitrogen depth profiles obtained from SIMS measurements. Additionally, XRD spectra are shown. A strong influence of microstructure on the nitrogen diffusivity in austenitic stainless steel was found as a smaller grain size increases diffusion. However, an additional effect of defects like twin boundaries and dislocations must be employed as the diffusion occurs within single grains (nitrogen range 1 – 5 μm vs. grain size of 10 – 40 μm) and the grain size is only a proxy of the underlying effect.

DS 24.65 Tue 15:00 P2

Chemical Behavior and Corrosion Resistance of Medical Grade Titanium after Surface Modification by Means of Ion Implantation — •Frank Schrempel[1], Gerhard Hildebrand[2], Marion Frant[2], Klaus Liefeith[2], and Werner Wesch[1] — [1]Institut für Festkörperphysik, Friedrich-Schiller-Universität Jena, Max-Wien-Platz 1, D-07743 Jena, Germany — [2]Institut für Bioprozess- und Analysenmesstechnik, Rosenhof, D-37308, Heilbad Heiligenstadt, Germany

This work presents data on topographical structure, chemical surface composition and physicochemical properties of medical grade titanium after implantation of 30 keV Na-, Ca- and P-ions with fluences in the order of 10^{17} cm^{-2}. Atomic force microscopy was used for surface analysis. The chemical composition was investigated using Rutherford backscattering spectrometry. Physicochemical investigations were carried out using contact angle and zetapotential measurements. The corrosion resistance was examined in simulated body fluid using cyclic voltametry. Whereas the depth distribution of P-atoms agrees with calculations, the concentration of Na- and Ca-atoms in the maximum of the depth distribution is significantly lower and the distribution extends to higher depths compared to the predictions. This finding is associated with a strong incorporation

of oxygen. According to topographical and chemical changes different contact angles as well as zetapotentials have been detected compared to pure titanium. Electrochemical examinations indicate that the implantation has no negative influence on the corrosion resistance. The results show that ion implantation with certain ions can be used to design tailor made titanium surfaces.

DS 24.66 Tue 15:00 P2

Burying Au-Nanoparticles into Si-Substrates by Ion-Irradiation — •Andreas Klimmer[1], Johannes Biskupek[2], Hans-Gerd Boyen[1], Ute Kaiser[2], and Paul Ziemann[1] — [1]Abt. Festkörperphysik, Universität Ulm — [2]ZE Elektronenmikroskopie, Universität Ulm

Arrays of Au nanoparticles, arranged hexagonally on top of Si substrates, were irradiated with 200 keV Ar^+ and Xe^+ ions of various fluences up to 10^{16} ions/cm^2. Characterisation of the bombarded samples was carried out using SEM, AFM and TEM measurements.

Above certain fluences (depending on the ion species) cross-sectional TEM measurements demonstrate that complete Au nanoparticles are buried within the Si substrate with their spherical shape conserved. A possible explanation of this effect refers to a viscious flow of the underlying substrate as a consequence of the ion irradiation [1]. In this model, the Au particles are driven into the Si substrate by capillary forces resulting from the difference between the Au surface energy and the interface energy of SiO_2-Au or Si-Au, respectively. As a consequence, the particles should not sink further, once they are completely covered by substrate material.

The above described ion induced particle sinking is studied in detail using Au nanoparticles with diameters ranging from 2 nm to 10 nm, applying ion irradiation at room temperature as well as at low temperatures (30 K).

[1] Y. Zhong et al., J. Appl. Phys. **94** 4432 (2003)

DS 24.67 Tue 15:00 P2

Interface optimization and templated self-organisation of Ni/Ag — •J. Petersen and S. G. Mayr — I. Physikalisches Institut, University of Göttingen, Friedrich-Hund-Platz 1, 37077 Göttingen, Germany

The systematic processing of surface or interface structures is of special interest particularly in the field of magnetic recording media and nanotechnology where either smooth or specifically patterned surfaces are required. We investigated the interface modification and structural changes during ion bombardment of Ni/Ag thin film bilayers, as well as the deposition on a prepatterned substrate.

For appropriate fluences the interface roughness of the bilayers shows a local minimum as has previously been observed for surfaces, indicating the interplay of smoothing and roughening effects. The underlying mechanisms are identified as radiation induced viscous flow, which is driven by the interface energy, as well as disordering by ion beam mixing.

We further report about a nanoscale ripple pattern, which is generated by ion bombardment under oblique incidence and is used as a template for the separation process of the immiscible system Ni/Ag.

We acknowledge K. Zhang, II. Physikalisches Institut, University of Göttingen for help with ion irradiation, as well as the SFB 602 TP B3 for financial support.

DS 24.68 Tue 15:00 P2

Characterization of 1/f-Noise during the Transition from Crystalline to the Amorphous State of the Binary Metal Alloy $AuIn_2$ by Ion Bombardment at Cryogenic Temperatures — •Moritz Trautvetter, Thomas Müller, and Paul Ziemann — Abteilung Festkörperphysik, Universität Ulm, D-89069 Ulm

Patterned polycrystalline $AuIn_2$ films (typical thickness 40 nm) were bombarded under cryogenic conditions (80 K) with 300 keV Argon and Helium ions. Under these conditions, the damage induced by the heavy Argon ions leads to complete amorphization of the film while for light Helium ions a defect rich but still polycrystalline state is obtained.

To characterize the 1/f-noise accompanying the ion induced stepwise amorphization, noise spectra are measured in situ at 80 K. For this purpose, a special type of correlation measurement technique is applied to detect the contribution of the 1/f-noise even below the thermal noise background. Further insight in what type of defects is causing the observed increase of the 1/f-noise due to ion irradiation can be obtained by combined annealing experiments, which reveal a significant reduction of the 1/f-noise whereas the accompanying resistance change is only small. In case of annealing the ion bombarded film at an elevated temperature close to crystallization, the previously ion induced 1/f-noise enhancement can be completely removed while the resistance of the still amorphous sample varies only by 2% due to this process.

DS 24.69 Tue 15:00 P2

Ion beam technology as a solution for EUV lithography — •Jens Dienelt[1], H. Neumann[1], M. Kramer[1], E. Schubert[1], B. Rauschenbach[1], M. Nestler[2], A. Tarraf[2], and M. Schultze[3] — [1]Leibniz-Institut für Oberflächenmodifizierung e.V. (IOM), Permoserstr. 15, 04318 Leipzig, Germany — [2]Roth & Rau Oberflächentechnik AG, Gewerbering 3, 09337 Hohenstein Ernstthal, Germany — [3]AIS Automation GmbH, Otto-Mohr-Straße 6, 01237 Dresden, Germany

A novel ion beam sputter deposition tool (Seg-IonSys-1900) for EUV mask blank fabrication and the pertaining deposition equipment will be presented. The main goal of this tool concept is to avoid the particle generation in the PVD deposition process by a special substrate motion and transfer system without losing the other required properties of the Mo/Si multilayer stack. The basis of this new concept idea is the application of a linear ECR ion beam source with a segmented grid system for beam profile control. The use of this ion beam source allows to minimize the substrate motion without loss of layer homogeneity and thickness stability in the deposition process itself. The ion beam source is equipped with a focused three grid extraction system, where high ion current densities results and with it deposition rate of 3.5 $Å s^{-1}$ for Si and 2.5 $Å s^{-1}$ for Mo. Based on this rates a total deposition time for a 50 multi layer stack of less than 45 min will be possible. With respect to this source and motion concept a special handling and transfer mechanism is demonstrated and the target drum construction with 16 single targets will be discussed in respect to the new concept and layer quality demands. Results of EUV-multilayer stacks with 50 pairs are discussed by reflectivity data (Cu-Kα and at EUV wavelength of 13.4 nm), TEM and AFM measurements.

DS 24.70 Tue 15:00 P2

Characterization of ion implanted titanium surfaces for medical application — •Stefan Krischok[1,2], Claudia Blank[3], Michael Engel[1,2], Richard Gutt[1,2], Gernot Ecke[2], Jens Schawohl[2], Lothar Spiess[2], Klaus Liefeith[3], Gerhard Hildebrand[3], and Juergen A. Schaefer[1,2] — [1]Institut für Physik, TU Ilmenau, P.O. Box 100565, 98684 Ilmenau — [2]Zentrum für Mikro- und Nanotechnologien, TU Ilmenau, P.O. Box 100565, 98684 Ilmenau — [3]Institut für Bioprozess- und Analysenmesstechnik e.V., 37308 Heiligenstadt

Titanium and its alloys are among the most biocompatible materials and therefore commonly used for orthopaedic and dental implants. They provide excellent biomechanical properties and chemical stability in biological systems. Main problems are the osteointegration and long term stability. Surface modifications like plasma spraying used in medical applications do not guarantee the desired long term stability. The implantation of ions into the near surface layer is a new approach to improve the osteointegration. We examined the surface topography, concentration profile of the observed elements as well as their chemical state and the crystallographic structure of ion (Ca, P, Na) implanted titanium surfaces. The characterization was performed by atomic force microscopy, X-ray photoelectron spectroscopy, X-ray diffraction and Auger electron spectroscopy depth profiling before and after exposing the samples to specific simulated body fluid supplemented with minerals. A strong influence of the surface properties on the cell response is observed; best results of the accomplished tests (biological and physical) were achieved for the co-implantation of calcium and phosphorus.

DS 24.71 Tue 15:00 P2

Nanostructure formation on ion eroded SiGe and Si surfaces — •Christian Hofer[1], Christian Teichert[1], Markus Wächter[2], Thomas Bobek[2], Heinrich Kurz[2], Klara Lyutovich[3], and Erich Kasper[3] — [1]Institute of Physics, University of Leoben, Austria — [2]Institute of Semiconductor Technology, RWTH Aachen, Germany — [3]Institute of Semiconductor Engineering, University of Stuttgart, Germany

Atomic Force Microscopy has been applied to study the morphological evolution of heteroepitaxial SiGe/Si(001) films and Si(001) substrates under normal incidence noble gas ion bombardment. For self organized films we investigate the influence of different starting morphologies and ion energies on the subsequent pattern formation. In general, two different energy regimes were found. For ion energies above 500 eV up to 1000 eV the surface smoothens, whereas in the low energy regime the

surface roughens and craters with a diameter of 70 nm evolve [1]. For samples with pyramidal pits surrounded by {105} faceted islands, the different sputter velocities of protrusions and pits could be revealed. The ion erosion of Si(001) results in the dot formation with inhomogeneous distribution. Here, the lateral dot sizes range from 30 nm to 40 nm with dot heights of 2 nm. The influence of the ion energy and sputter depth on the pattern formation is discussed.

Research supported in the framework of the EC project NAMASOS (Nanomagnets by Self-Organisation, STRP 505854-1) and by FWF Austria, P14009-TPH. www.unileoben.ac.at/˜spmgroup

[1] C. Hofer et al., Nucl. Instrum. Meth. B. 216, 178 (2004).

DS 24.72 Tue 15:00 P2

Growth of thin epitaxial titanium nitride films by using hyperthermal particle fluxes — •A. Wolfsteller, J.W. Gerlach, T. Höche, and B. Rauschenbach — Leibniz-Institut für Oberflächenmodifizierung (IOM) e.V., Permoserstr. 15, D-04318 Leipzig

In order to achieve a higher complexity and versatility of the conventional ion beam assisted deposition of metal nitride films, the metal component having thermal energies can be replaced with the metal component possessing hyperthermal energies. Here, results on the ion beam assisted deposition of thin TiN films by using hyperthermal titanium ions are presented. Hyperthermal titanium ions were produced by a pulsed dc vacuum arc metal plasma source, while a constricted glow-discharge plasma source delivered hyperthermal nitrogen ions The TiN films were deposited at various substrate temperatures on $Al_2O_3(0001)$ and MgO(100) substrates, simultaneously. Thus, substrate influences on the film growth could be identified and separated from influences arising from the ion beam parameters. During the deposition, the surface structure of the films was monitored by RHEED. The crystallographic structure and texture was investigated by XRD. High resolution TEM was used to examine the morphology and defect structure of the films. The results show that the TiN films are epitaxial even at room temperature, indicating the beneficial effect of the hyperthermal energy of the particles involved in the deposition process. The influences of the different substrates and the ion beam parameters on the crystalline quality of the films are discussed.

DS 24.73 Tue 15:00 P2

Properties of multiferroic $BiFeO_3$ thin films grown by pulsed laser deposition — •Patrick Schützendorf[1], Regina Dittmann[1], Bernd Holländer[2], Hermann Kohlstedt[1], and Rainer Waser[1] — [1]Institut für Festkörperforschung, Forschungszentrum Jülich GmbH, D- 52425 Jülich — [2]Institut für Schichten und Grenzflächen, Forschungszentrum Jülich GmbH, D- 52425 Jülich

Thin films of the multiferroic material $BiFeO_3$ (BFO) exhibit huge remnant polarization values up to $150\mu C/cm^2$ [1]. The maximum polarization is obtained for the (111) orientation with the polarization being up to twice as large as the polarization along the (100) axis [2].

To further investigate the different polarization directions, we have grown BFO thin films on $SrRuO_3$ buffered STO(100) and STO(111) substrates by PLD. The influence of the deposition conditions on the growth of BFO thin films was investigated using XRD, AFM, RBS and TEM.

Below the decomposition temperature of about 800°C, between 700°C and 650°C we obtained (111) and (100) oriented films for (111) and (100) oriented substrates, respectively. We achieved rocking curves widths of about 0.11°. For 600°C a second phase was observed in BFO thin films grown on (100) substrates. For (111) oriented films we obtained a surface roughness of about 7 nm whereas for (100) oriented films a surface roughness of about 0.25 nm could be achieved.

We will present the electrical behaviour of the BFO thin films as a function of deposition conditions and the orientation of the films.

[1] K.Y. Yun et al., Jpn. J. Appl. Phys. **43**, L647 (2004)
[2] J. Wang, et al., Sciene **299**, 1719 (2003)

DS 24.74 Tue 15:00 P2

Microstructure and mechanical properties of pulsed laser deposited PMMA and PMMA-metal structures — •Thorsten Scharf, Johanna Röder, Erik Süske, Jörg Faupel, and Hans-Ulrich Krebs — Institut für Materialphysik, Universität Göttingen, Friedrich-Hund-Platz 1, D-37077 Göttingen

Thin films of composite materials are of high interest for a wide range of applications. Especially nano-composites consisting of different material classes, e.g. polymers and metals, are difficult to prepare. Here pulsed laser deposition (PLD) is an interesting preparation technique due to its flexibility. On this poster the growth mechanisms of different metals on laser deposited PMMA will be discussed with a focus on the possibility to modify the growth. By depositing metals of different reactivity acting as nucleation seeds it is possible to control the cluster size distribution and therefore for instance the optical properties. The mechanical properties, especially of the polymeric part of the films, are changed during deposition due to the PLD process. They can be measured by mechanical spectroscopy, which was performed using an new *in-situ* setup. Experimental details as well as results will be presented and discussed in this contribution.

DS 24.75 Tue 15:00 P2

Process characterization of pulsed laser deposited PMMA — •Britta Lösekrug, Thorsten Scharf, Erik Süske, and Hans-Ulrich Krebs — Institut für Materialphysik, Universität Göttingen, Friedrich-Hund-Platz 1, D-37077 Göttingen

The pulsed laser deposition (PLD) is a flexible and effective method for producing thin films of different materials, also polymers like PMMA poly (methyl methacrylate), which is an attractive coating material. Thin films of PMMA consist of two components, one fraction with molecular weight well below that of the target material and a second fraction, which is cross-linked. The non-cross-linked fraction forms droplets on the flat surface of the cross-linked part. Origins in the deposition process of these two components are different and show different angular distributions. By varying the laser fluence during deposition the amount of cross-linking is changed. Another possibility to influence the deposition process is a variation of the absorption coefficient by embedding a strong absorbing material. In this contribution the influence of these different parameters on the laser deposited PMMA films is presented and discussed.

DS 24.76 Tue 15:00 P2

Laser Nitriding of Titanium with various Lasers and Investigation of the Produced TiN_x Coatings — •Daniel Höche, Hendrik Schikora, and Peter Schaaf — Universität Göttingen, II. Physikalisches Institut, Friedrich-Hund-Platz 1, 37077 Göttingen, Germany

Pure titanium has been nitrided with different lasers under nitrogen atmosphere. This opens the possibility of comparing various parameters and their influence on the nitriding effect and the properties of the produced TiN coatings. Consecutively the properties of these TiN_x coatings have been measured and characterized through their macroscopic features like hardness and wear resistance and their microscopic properties like texture, nitrogen profile and so on. Solving the time dependent partial differential equation of the heat problem:

$$\rho\frac{\partial H}{\partial t} = \nabla\cdot(\kappa\nabla T) + \alpha e^{-\alpha z}(1-R)I(r,t)$$

nitrogen diffusion and growing mechanism have been described. Additional information about the relationships between growing direction (dendrites), texture and laser resp. processing parameters will be shown. Finally it is the aim to give an overview about the complicated effects for laser nitriding of titanium.

DS 24.77 Tue 15:00 P2

Synthesis of FeCo thin films by advanced PLD — •Christian Lange, André Holz, Hendrik Schikora, and Peter Schaaf — Universität Göttingen, II. Physikalisches Institut, 37077 Göttingen, Germany

FeCo alloys of near-equiatomic composition offer exceptional magnetic properties. In this work, FeCo thin films were synthesized using advanced pulsed laser deposition, i.e. ion beam assisted deposition and different bias voltages were applied to study the influences on microstructure and magnetic properties of the films.

Structure analyses were performed with Rutherford backscattering spectrometry (RBS), X-Ray Diffraction (XRD) and conversion electrons Mössbauer spectroscopy (CEMS), while magnetic properties were examined by magneto-optical Kerr effect (MOKE) and magnetic orientation Mössbauer spectroscopy (MOMS).

Results show a strong correlation between deposition parameters (gas atmosphere and pressure, deposition rate) and the magnetic properties of the synthesized thin films.

DS 24.78 Tue 15:00 P2

Pulsed laser deposition and ordering of thin FePt films — •André Holz, Christian Lange, and Peter Schaaf — Universität Göttingen, II. Physikalisches Institut, Friedrich-Hund-Platz 1, 37077 Göttingen, Germany

Thin FePt-multilayer films with different film-thicknesses of the individual layers (0.5 nm - 10 nm) have been produced on MgO(100)-substrates by Pulsed Laser Deposition (PLD) with an Excimer laser. Annealing at different temperatures, ion-beam implantation with Xenon and ion-beam assisted deposition with Argon-ions for increased mobility on the substrate have been used in order to obtain an ordered FePt film with $L1_0$ structure and to study the necessary ordering effects. The films were examined by XRD, RBS, MOKE, Mössbauer spectroscopy, MOMS and SEM. Texturing effects and magnetic anisotropy were observed.

DS 24.79 Tue 15:00 P2

Charakterisierung von Mikrostrukturen mittels ortsaufgelöster RBS- und PIXE-Analyse — •Tilo Reinert and Christoph Meinecke — Institut für Experimentelle Physik II, Universität Leipzig Linnéstr.5, 04103 Leipzig

Die DFG-Forschergruppe 522 "Architektur von nano- und mikrodimensionalen Strukturelementen" beschäftigt sich mit der Herstellung, Charakterisierung und Analyse neuartiger Architekturen, die als funktionelle Grundbausteine für zukünftige Anwendungen in der Nanomechanik, Sensorik, Photonik und Elektronik studiert werden. Neben der funktionellen Charakterisierung ist auch eine morphologische und stoffliche Analyse essentiell für das Verständnis ihrer neuartigen Eigenschaften. Dabei stoßen herkömmliche Ionenstrahl-Analysemethoden (RBS, PIXE) wegen der nano- und mikroskaligen, drei-dimensionalen Untersuchungsobjekte an ihre Grenzen. Erst die Verwendung von fokussierten MeV-Ionenstrahlen (He^+, H^+) mit einer lateralen Ortsauflösung im sub-Mikrometerbereich ermöglicht die Analyse heterogener Mikro- und Nanostrukturen. An der Leipziger Hochenergie-Ionen-Nanosonde LIPSION wird deshalb die Entwicklung einer quantitativen und hochempfindlichen Analytik zur 3D-Charakterisierung verfolgt. Im ersten Schritt wurde die laterale Ortsauflösung bei RBS und PIXE auf unter 500 nm verbessert. Damit konnten bereits einige Strukturen (Kylindrit, GaAs/GaInAs/AlAs, optische Mikroresonatoren) analysiert werden. Ein zweiten Schritt ist in Vorbereitung. Durch die Verwendung eines facettierten Teilchendetektors für RBS wird die Tiefenprofilierung und damit die 3D-Charaktrerisierung verbessert.