DS 12: Postersession DS

Presenters are kindly requested to be near their poster for at least one hour during poster session or leave a note about their availability for discussions.

Time: Monday 17:00–19:00 Location: Poster A

DS 12.1 Mon 17:00 Poster A

Ultrathin multilayers grown by pulsed laser deposition — •Bea Jaquet, Christian Eberl, Florian Döring, and Hans-Ulrich Krebs — Institute for Materials Physics, University of Göttingen, Friedrich-Hund-Platz 1, 37077 Göttingen, Germany

The physical properties of multilayers with layer periods in the nanometer range (way below 5 nm) crucially depend on the chosen material combination, their crystalline or amorphous state, heat of mixing of the chosen system, and amount of intermixing. For this, ultrathin multilayers consisting of different materials (metals, oxids, semiconductors) are grown by pulsed laser deposition (PLD) with layer periods of high quality. The structure, microstructure and interface roughness of the different multilayers were characterized by x-ray reflectivity (XRR), x-ray diffraction (XRD) and (high resolution) transmission electron microscopy (TEM). In this contribution we discuss the properties of the multilayers with respect to the used material combinations.

DS 12.2 Mon 17:00 Poster A

Long term XPS analysis of Fe/GaAs(001) — •Karim Shamout[1,2], Dominique Krull[1,2], Philipp Espeter[1,2], Christoph Keutner[1,2], Ulf Berges[1,2], and Carsten Westphal[1,2] — [1]TU Dortmund, Dortmund, Deutschland — [2]DELTA, Dortmund, Deutschland

The III-V compound semiconductor gallium arsenide is an applicable substrate for spintronic multi-layer systems due to its electronic und magnetic properties. The structure of the 3-layers the system MgO/Fe/GaAs(100) has already been discussed in detail and it has been shown that the Ga-rich surface reconstruction of GaAs(4x2) can be investigated beneath the MgO and Fe layer by x-ray photoelectron diffraction (XPD) [1]. Since these XPD measurements last several hours and iron is highly reactive even at pressures $p < 2{\cdot}10^{-10}$ mbar this study focuses on the long term oxidation of an Fe-film prepared on GaAs(001). Within this work, we demonstrate that XPD measurements of samples with terminating FE layers at the surface must be carried out as quickly as possible in order to avoid oxidation levels.

[1] D. Handschak, T. Lühr, F. Schönbohm, S. Döring, C. Keutner, U. Berges and C. Westphal. Phys. Rev. B, 88:045313, 2013

DS 12.3 Mon 17:00 Poster A

Bi atoms mobility-driven self-organized circular domains at the Bi/InAs(111) interface — •Maria Christine Richter[1,2], Abdoul Gafoor[1], Laurent Nicolaï[1,2,3], Jan Minar[3,4], Jürgen Braun[3], Hubert Ebert[3], Uros Djukic[1], Olivier Heckmann[1,2], Jean-Michel Mariot[5], Nick Barett[2], Vitaly Feyer[6,7], Claus M Schneider[6], and Karol Hricovini[1,2] — [1]LPMS, Université de Cergy-Pontoise, Cergy-Pontoise, France — [2]DSM/IRAMIS/SPEC, CEA Saclay, Gif-sur-Yvette, France — [3]LMU Munich, Munich, Germany — [4]University of West Bohemia, Czech Republic — [5]LCP-MR, Université P et M Curie, Paris, France — [6]Peter Grünberg Institute (PGI-6), JARA-FIT, Research Center Jülich, Jülich, Germany — [7]NanoESCA beamline, Sincrotrone Trieste, Area Science Park, Basovizza, Italy

30 ML Thick Bi film deposition on the InAs(111)-A side and subsequent annealing at 600 K leads to self-organized circular structures with the diameter of several μm. Spatial analysis by PEEM of Bi 5d, In 4d and As 3d core-level photoemission spectra shows that the circular patterns are composed of the unaltered InAs substrate coverd by a thin Bi layer. The spots in the middle of the circles are Bi cristallites and the region in between them are In-poor and As-rich ternary compounds. From the k-resolved PEEM spectra along the Γ-M line we estimate that the medium thickness of the Bi-layer is approximately one monolayer. The InAs(111)-B side shows no particular morphology but stronger chemical shifts of the core-level spectra evidencing Bi-As bonds.

DS 12.4 Mon 17:00 Poster A

Texture Optimization of the Binary Compound Sb_2Te_3 by Using UHV DC Magnetron Sputter Deposition — •Artur Romanov, Carolin C. Jacobi, Matthias M. Dück, and Matthias Wuttig — I. Institute of Physics (IA), RWTH Aachen University, Aachen, Germany

The binary compound Sb_2Te_3 exhibits extraordinary thermoelectric properties. These are desirable for a range of industrial applications, e.g. for solid state refrigerators. Additional to its applicability, Sb_2Te_3 is of high fundamental scientific interest since it was identified as a topological insulator (TI). In order to develop the surface states, that enable the topological properties, a high texture quality of the deposited thin film is needed. Highly textured films are usually produced with elaborate methods like Molecular Beam Epitaxy (MBE). However, recently textured films were successfully produced using the sputter deposition method. In contrast to MBE, sputter deposition offers benefits for industrial applications like convenient scalability and high deposition rates. The choice of process parameters was found to influence the quality of the deposited thin film heavily. Accompanied by the growth type, changes can occur in texture and electrical properties. The limit of texture optimization is not yet achieved and requires further investigation. Goal of this project is to establish an efficient and fast method to produce Sb_2Te_3 in a texture similar to MBE. The film's texture is determined by x-ray diffraction (XRD), in particular employing measurements of Rocking Curves and measurements using Bragg-Brentano geometry.

DS 12.5 Mon 17:00 Poster A

RBS-Investigations of Mo-doped $BiVO_4$ thin films deposited by reactive magnetron sputtering — •Marie Mende[1], Emanuel Schmidt[1], Fuxian Wang[2], Klaus Ellmer[2], and Elke Wendler[1] — [1]Institut für Festkörperphysik, Friedrich-Schiller-Universität Jena, Helmholtzweg 3, 07743 Jena, Germany — [2]Helmholtz-Zentrum Berlin für Materialien und Energie, Hahn-Meitner-Platz 1, 14109 Berlin, Germany

Bismuth vanadate ($BiVO_4$) has recently emerged as a promising material for the use as photoanode in solar water splitting applications. However, the performance of $BiVO_4$ as photoanode material is strongly limited by its intrinsically slow electron and hole transport.

In order to overcome these limitations, novel doping strategies have been developed. To benefit from these modification and fabrication methods an extensive control of the composition and the dopant concentration must be guaranteed.

In this work we investigate molybdenum doped thin film samples of $BiVO_4$ deposited on glassy carbon or (100) yttria-stabilized zirconia (YSZ) substrates with different dopant contents by reactive magnetron sputtering from a Bi and a V target. Rutherford-Backscattering-Spectroscopy (RBS) is used to determine the structure (epitaxial growth) and composition of these layers for assisting further investigations regarding the dependence of photocatalytic activity on the material composition and doping.

DS 12.6 Mon 17:00 Poster A

Twins and Strain in magnetron sputtered epitaxial perovskite oxide films — •Immo Bahns, Patrick Thiessen, Jörg Hoffmann, and Christian Jooss — Uni Göttingen

Because of the large acoustic mismatch multilayers composed of the perovskites SrTiO3 (STO) and Pr0.65Ca0.35MnO3 (PCMO) are interesting model systems for phonon blocking structures. However, the thermal conductivity is significantly affected by strain effects due to the lattice mismatch and preparation-caused defects. In addition, PCMO films are commonly highly twined because of the cubic-to-orthorhombic phase transition. In this contribution we investigate the homoepitaxial growth of STO films on (100) STO substrates and the heteroepitaxial growth of PCMO on STO. The about 200 nm thick films were prepared by magnetron-sputtering of the oxide targets in an argon/oxygen gas mixture. The deposition temperatures were varied between 600 and 800 °C. Phase formation, lattice constants and therefore the strain state are deduced from X-ray inspections. Since PCMO belongs to the class of manganites with a pronounced Colossal Magneto-Resistance effect (CMR) and the CMR is very sensitive with respect to point-like disorder, magnet field dependent resistivity

measurements were performed. We also discuss the influence of the deposition parameters on the formation of the 6 twin domains.

DS 12.7 Mon 17:00 Poster A

evaluation of structure and mechanical properties of Ni-rich/ Ti-rich NiTi thin film — •Maryam Mohri[1,2], Mahmoud Niliahmadabadi[2], Julia Ivanisenko[1], and Horst Hahn[1] — [1]Karlsruhe Institute of Technology, Institute of Nanotechnology, 76021 Karlsruhe, GermanyKarlsruhe Institute of Technology, Institute of Nanotechnology, Karlsruhe, Germany — [2]School of Metallurgy and Materials Engineering, College of Engineering, University of Tehran, Tehran, Iran.

NiTi alloys have received more attraction for a wide range of smart designs and innovative applications due to shape memory effect and pseudo elasticity. In this paper, the gradient structure and mechanical properties of a martensitic/austenitic (Ni49Ti/Ni51Ti (at.%)) bi-layered thin film with 1000nm thickness deposited using DC magnetron sputtering on Si substrate and subsequent annealing were studied. The structure, transformation temperatures and mechanical properties of the bi-layer were analyzed using grazing incidence X-ray diffraction (GIXRD), scanning transmission electron microscopy, differential scanning calorimetry (DSC) and nanoindentation. The X-ray diffraction results indicated that the bi-layer was composed of austenitic and martensitic layers. The bi-layered thin film exhibited a combined pseudo elastic behavior and shape memory effect specific to the austenitic and martensitic thin films, respectively. The combination of pseudo elastic effect with shape memory leads to a two-way shape memory effect with a reduced hysteresis in the bi-layers.

DS 12.8 Mon 17:00 Poster A

Control of octahedral rotations in LaNiO3/LaGaO3 superlattices via octahedral connectivity at heterointerfaces — •Haoyuan Qi[1], Michael Kinjanjui[1], Xiaodan Chen[1], Johannes Biskupek[1], Dorin Geiger[1], Eva Benckiser[2], Hanns-Ulrich Habermeier[2], Bernhard Keimer[2], and Ute Kaiser[1] — [1]University of Ulm, Central Facility of Electron Microscopy, Electron Microscopy Group of Materials Science, Albert Einstein Allee 11, D-89081 Ulm, Germany — [2]Max Planck Institute for Solid State Research, Heisenbergstrasse 1, D-70569 Stuttgart, Germany

For ABO3 perovskites, octahedral rotations and distortions couple strongly to the functional properties. However, precise control of the octahedral rotations in ABO3 heterostructures remains challenging. By using aberration-corrected HRTEM, we investigated the local octahedral rotations in [(4 unit cell (u.c.)//4 u.c.)*8] and [(1 u.c.// 4 u.c.)*13] LaNiO3/LaGaO3 superlattices grown on tensile-strain inducing (001) SrTiO3 substrates. For the [(4 u.c.// 4 u.c.)*8] LaNiO3/LaGaO3 superlattice, the NiO6 octahedral rotations were found to be relaxed to bulk value near the surface of the superlattice indicating that epitaxial strain alone is not enough to stabilize certain octahedral rotational magnitudes throughout the entire superlattice. For the [(1 u.c.// 4 u.c.) *13] LaNiO3/LaGaO3 superlattice, the NiO6 octahedral rotations have the same magnitudes as the neighboring GaO6 octahedra due to interfacial octahedral connectivity. Our study has demonstrated that octahedral rotations in ABO3 heterostructures can be precisely controlled via octahedral connectivity at heterointerfaces.

DS 12.9 Mon 17:00 Poster A

Ultrafast structural deformation studied by time-resolved x-ray diffraction — •Mathias Sander[1], Azize Koc[2], Christelle Kwamen[2], Matthias Reinhardt[2], Wolfram Leitenberger[1], Peter Gaal[2,3], and Matias Bargheer[1,2] — [1]Institut für Physik und Astronomie, Universität Potsdam, Karl-Liebknecht-Str. 24/25 14476 Potsdam — [2]Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Wilhelm-Conrad-Röntgen Campus, Bessy II, Albert-Einstein-Str. 15, 12489 Berlin — [3]Institute for Nanostructure and Solid State Physics, University of Hamburg, Jungiusstr. 11c/352, 20335 Hamburg

We investigate the ultrafast dynamics of coherent acoustic phonons in a photo-excited thin film. The excitation of the sample with an ultrashort laser pulse triggers coherent expansion and compression waves within the thin layer, which modulate the diffraction efficiency of an x-ray probe pulse on the picosecond timescale. A novel sample structure extinguishes the diffraction background from the laser deposited heat which is essential for repetition rates of 200kHz. The structure can be employed as ultrafast switchable mirror to shorten bursts of hard x-rays emitted from synchrotron storage rings. In addition, we study the in-plane sample dynamics by intersecting two optical pump pulses at the sample surface. The generated transient grating is characterized by x-ray reflection under grazing incidence and by reciprocal space mapping. The diffraction efficiency of the thermal grating can be tuned by the incoming laser fluence.

DS 12.10 Mon 17:00 Poster A

A critical look at the resolution function of a TOF neutron reflectometer and why we should care when we do GISANS experiments — •Jean-François Moulin and Sebastian Busch — German Engineering Materials Science Centre (GEMS) at Heinz Maier-Leibnitz Zentrum (MLZ), Helmholtz-Zentrum Geesthacht GmbH, Lichtenbergstr. 1, 85747 Garching bei München, Germany

Grazing incidence small angle neutron scattering (GISANS) is increasingly used to characterize the structure of thin films. This method makes it possible to detect lateral correlations over a broad range of length scales (from nm to μm). Because the probing wave is evanescent one can tune the depth from which the scattering originates. This makes it in theory possible to perform structural depth profiling, but unfortunately the penetration depth is a very steep function of the wavelength (or incident angle) which means that high resolution measurements are needed or at the very least that a good knowledge of the resolution function is fundamental. We will show a detailed analysis of the resolution function of a time-of-flight neutron reflectometer and illustrate how the data binning scheme as well as the primary wavelength spectrum shape can affect the accuracy of penetration depth measurements. The influence of these resolution effects in the case of conventional reflectivity measurements will also be discussed.

DS 12.11 Mon 17:00 Poster A

Towards Imaging of Defects in Diamond by High-Resolution TEM — •Robert Leiter[1], Haoyuan Qi[1], Johannes Biskupek[1], Boris Naydenov[2], Fedor Jelezko[2], and Ute Kaiser[1] — [1]Electron Microscopy Group of Materials Science, University of Ulm, Albert-Einstein Allee 11, 89081 Ulm, Germany — [2]Institute for Quantum Optics, University of Ulm, Albert-Einstein Allee 11, 89081 Ulm, Germany

Nitrogen-vacancy (NV), Silicon-vacancy (SiV) and other colour centres in diamond have been of rising interest in recent years due to their potential applications, such as quantum information processing[1] and fluorescent labelling in biology. For biological applications, NV and SiV centres can be created in nanodiamonds with sizes down to less than 10 nm[2,3]. Although structural characterisation of NV-centres has been done by optical and magnetic resonance methods, structure of other colour centres often remain uncovered. By using aberration-corrected high-resolution transmission electron microscopy (HRTEM), atomic resolution can be achieved. However, the imaging conditions necessary to directly image the structure of an SiV, GeV and other new centres remain unclear. Here we explore the imaging conditions that are suitable for this problem by means of image simulations and subsequent testing using an FEI TITAN image-side aberration corrected TEM operated at 80 kV and 300 kV.

[1] F. Jelezko & J. Wachtrup, phys. stat. sol. a 203, 3207-3225 (2006)

[2] J. Tisler et al., ACS Nano 3, 1959-1965 (2009)

[3] I. Vlasov et al., Nature Nanotechnology 9, 54-58 (2014)

DS 12.12 Mon 17:00 Poster A

Kavitationserosion als Haftungstest für chromdotierte Aluminiumoxidschichten auf unterschiedlichen Substraten — •Ingo Erdmann[1], Friederike Deuerler[1], Ali Haligür[2] und Volker Buck[2] — [1]Fakultät 7, Fachgebiet Werkstofftechnik, Bergische Universität Wuppertal — [2]Falkultät für Physik, AG Dünnschichttechnologie, Universität Duisburg-Essen

Die Signalintensität thermographischer Phosphore ist proportional zu ihrem Volumen und hängt damit bei dünnen Schichten von der Schichtdicke ab. Da die mechanischen Spannungen in einer dünnen Schicht in der Regel proportional zur Schichtdicke ansteigen, führt dieser Effekt oft zu einem Abplatzen der Schicht, wenn eine spezifische Dicke erreicht wird, wodurch die maximal erreichbare Schichtdicke begrenzt wird. Die untersuchten chromdotierten Aluminiumoxidschichten wurden in einem plasmaunterstützten CVD-Prozess mit unterschiedlichen Beschichtungszeiten (d.h. unterschiedlichen Schichtdicken) auf Silizium- und Edelstahlsubstraten abgeschieden. Es zeigte sich, dass bis zu Dicken von etwa 20 Mikrometern (wo ausreichende Intensität der Phosphoreszenz gegeben ist) kein Abplatzen der Schichten beobachtet werden konnte. Die Schichten wurden anschließend einer Kavitationserosion gemäß ASTM G32-98 ausgesetzt und der Grad des Schichtversagens nach unterschiedlichen Kavitationszeiten optisch erfasst und quantifi-

ziert, woraus sich die jeweilige Kavitationsrate ergab. Hierbei zeigte sich eine deutlich geringere Kavitationsrate der Schichten auf den Siliziumsubstraten im Vergleich zu den verwendeten Edelstahlsubstraten, was einer signifikant höheren Schichthaftung auf Silizium entspricht.

DS 12.13 Mon 17:00 Poster A

Drastic deviations from stoichiometry transfer during pulsed laser deposition — •Christina Klamt, Arne Dittrich, Christian Eberl, Susanne Schlenkrich, Felix Schlenkrich, Florian Döring, and Hans-Ulrich Krebs — Institute for Materials Physics, University of Göttingen, Friedrich-Hund-Platz 1, 37077 Göttingen, Germany

In common, one of the most characteristic properties of pulsed laser deposition (PLD) is the stoichiometry transfer between target and substrate, which has been used heavily for many complex systems. In this contribution we show that it is yet possible to obtain drastic deviations from stoichiometry transfer in a binary system by just varying the fluence during laser deposition. In the W-Cu system, the W-concentration of films grown from either a W60Cu40 or a W80Cu20 target (wt. %) can indeed continuously be changed over an unprecedented large range of 0 to 75 wt. % W. Close to the deposition threshold, pure Cu-films are formed due to the much higher vapor pressure of Cu. At higher laser fluences, more and more W-rich W-Cu alloy samples are obtained, since ion implantation and intermixing processes occur. These alloys can reach W-contents even higher than that of the target because of enhanced resputtering and reflection of the lighter Cu atoms at the film surface. Stoichiometric films are only obtained at laser fluences around $3\,J/cm^2$, when the strong Cu evaporation from the target and reflection and resputtering effects of Cu at the film surface are in balance.

DS 12.14 Mon 17:00 Poster A

Phonon, structural and magnetic properties of ordered double perovskite A_2BMnO_6 (A = La, Pr, Nd, Sm, Gd, Y, B = Co, Ni) thin films — •Christoph Meyer, Bernd Damaschke, Konrad Samwer, and Vasily Moshnyaga — I. Physikalisches Institut, Georg-August-Universität Göttingen, Friedrich-Hund-Platz 1, 37077 Göttingen

B-site ordered double perovskites A_2BMnO_6 (A =rare earth; B = Co, Ni) with monoclinic $P12_1/n1$ structure are promising materials for spintronic applications due to ferromagnetic ordering, magnetodielectric coupling and multiferroic behavior. To study the influence of A- and B-site cations, we grew series of A_2BMnO_6 (A=La, Pr, Nd, Sm, Gd, Y; B=Co, Ni) thin films on $SrTiO_3(111)$, $SrTiO_3(100)$ and MgO (100) substrates by metalorganic aerosol deposition. The films were analyzed by X-ray diffraction (XRD), magnetization measurements (SQUID) and far-field Raman and tip-enhanced Raman spectroscopy (TERS). All films are epitaxially and obey monoclinic $P12_1/n1$ structure with superlattice reflections in the cubic [111] direction due to high degree of B-site ordering. Ferromagnetic ordering with high T_C and a strong A_g symmetry mode of B/MnO_6 octahedral stretching at $\sim 630 - 670$ cm^{-1} in the TERS and far-field Raman spectra were detected. Enhanced T_C and A_g mode frequency values for A_2NiMnO_6 compared to A_2CoMnO_6 and a systematic reduction of T_C and the stretching mode frequency by decreasing the A-site cation size were observed. Financial support by the DFG via project SFB 1073/B04 is gratefully acknowledged.

DS 12.15 Mon 17:00 Poster A

Raman spectroscopy of crystal field excitations and vibration modes in $CePt_5$ surface layers — •Benedikt Halbig[1], Utz Bass[1], Martin Zinner[2], Kai Fauth[2], and Jean Geurts[1] — [1]Universität Würzburg, Exp. Physik III, Würzburg, Germany — [2]Universität Würzburg, Exp. Physik II, Würzburg, Germany

The rare-earth compound $CePt_5$ is highly relevant for heavy-fermion quasiparticles and Kondo physics. The Ce 4f electron energy levels are split by the crystal field of their neighbor atoms by about 20 meV. We report on the detection of this splitting by Raman spectroscopy from electron crystal field excitations (CFE) in $CePt_5$ surface layers with thicknesses between 2 and 16 unit cells, grown in UHV by annealing-induced alloying on Pt(111) substrates. For reference, $LaPt_5$ layers were employed, i.e. without 4f electrons. The crystal lattice consists of alternating $CePt_2$- ($LaPt_2$-) and Pt-kagome layers, whereas the surface is a hexagonal Pt layer. Depending on the $CePt_5$ layer thickness, up to three peaks in the $in-situ$ UHV Raman spectra at T≈20K are identified as CFE of the 4f electron because of their absence for the $LaPt_5$ reference samples. Their energies are 17meV, 23meV and 25meV. From their individual thickness-dependent intensity behavior, we assign them to CFE transitions at the Pt(111)-$CePt_5$ interfaces, in the $CePt_5$ layer, and at the $CePt_5$-Pt surface layer, respectively. Besides, we observe three additional Raman peaks: one is assigned to the E_{2g} vibration mode of the $CePt_5$ lattice, the other two to the near-surface part of the $CePt_5$ layer, whose symmetry is reduced by shifted Pt layers. Equivalent vibration peaks occur for the $LaPt_5$ reference.

DS 12.16 Mon 17:00 Poster A

Evaluation of graphite defects by microscopic ellipsometry — •Shun Okano[1], Jana Kalbacova[1], Constance Schmidt[1], Christoph Günther[1], Raul D. Rodriguez[1], Elias Garratt[2], Babak Nikoobakht[2], Ovidiu D. Gordan[1], Angela Hight Walker[3], and Dietrich R. T. Zahn[1] — [1]Technische Universität Chemnitz Semiconductor Physics, Chemnitz, 09126 — [2]Materials Measurement Science Division, National Institute of Standards and Technology, Gaithersburg, MD 20899, USA — [3]Semiconductor and Dimensional Metrology Division, National Institute of Standards and Technology, Gaithersburg, MD 20899, USA

Carbon materials, for instance graphite, graphene, or CNTs, are interesting for many modern applications. Therefore it is important to investigate defects in these materials. Since defects have a great effect on the properties of the material, like the refractive index, we focused on the investigation of defects by microscopic ellipsometry and compare the results with those from micro-Raman spectroscopy which is an established method for the characterization of defects. Defects on highly ordered pyrolytic graphite were produced by a focused Ga^+ ion beam with ion fluence ranging from $3{\cdot}10^{10}$ to 10^{15} ions/cm^2 in areas of 5×5 μm^2. The sample was investigated using an ellipsometry mapping, with an Accurion Nanofilm EP4 setup. With this we can visualize the defects the Ψ and Δ maps and determine the changes of refractive index and optical constants.

DS 12.17 Mon 17:00 Poster A

Raman spectroscopic investigations of Sr_2IrO_4 epitaxial thin films — •Cameliu Himcinschi[1], Chengliang Lu[2], Jens Kortus[1], and Marin Alexe[3] — [1]TU Bergakademie Freiberg, Institute of Theoretical Physics, D-09596 Freiberg, Germany — [2]Max Planck Institute of Microstructure Physics, Weinberg 2, D-06120 Halle, Germany — [3]Department of Physics, University of Warwick, Coventry CV4 7AL, United Kingdom

5d material systems, as Sr_2IrO_4 oxides, have interesting properties due to the strong spin-orbit coupling. Epitaxial Sr_2IrO_4 thin films were grown on $SrTiO_3$, $DyScO_3$ and $LaAlO_3$ substrates by pulsed laser deposition. The films were investigated using temperature dependent Raman spectroscopy. The larger compressive strain of the film deposited on $LaAlO_3$ induced a blue shift of the Sr_2IrO_4 Raman active modes. On the other hand, by using different excitation wavelengths the conditions for resonant Raman effect in Sr_2IrO_4 material have been probed.

DS 12.18 Mon 17:00 Poster A

Influence of Graphene on Charge Transfer between CoPc and Metals: The Role of Graphene-Substrate Coupling — Johannes Uihlein[1], Małgorzata Polek[1], Mathias Glaser[1], Hilmar Adler[1], David Balle[1], Ruslan Ovsyannikov[2], •Milutin Ivanovic Ivanovic[1], Alexei B. Preobrajenski[3], Alexander V. Generalov[3], Thomas Chassé[1], and Heiko Peisert[1] — [1]University of Tübingen, Institute of Physical and Theoretical Chemistry, 72076 Tübingen, Germany — [2]Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, 12489 Berlin, Germany — [3]Lund University, MAX-Laboratory, 22100 Lund, Sweden

The electronic structure of cobalt phthalocyanine (CoPc) on Pt(111), graphene/Pt(111) and Au-intercalated graphene/Ni(111) is investigated by photoemission and X-ray absorption spectroscopy. For CoPc on metal substrates, significant changes of the shape of the spectra indicate a charge transfer from the substrate to the Co ion of CoPc. The disturbance of the graphene electronic structure by interaction with underlying substrate accompanied by a doping of graphene has been found to affect electronic properties of adsorbed CoPc considerably.

DS 12.19 Mon 17:00 Poster A

Controlling the energetics at the interface of p-doped low band gap polymer — •Milutin Ivanović, Heiko Peisert, and Thomas Chassé — University of Tübingen, Institute of Physical and Theoretical Chemistry, 72076 Tübingen, Germany

Polymer/fullerene based organic photovoltaic cells (OPVCs) have been extensively investigated as a promising technology for the rising energy demand, in particular due to their low cost production potential. One approach to achieve more efficient OPVCs is the molecular p-doping of the polymer in thin films affecting the energy level alignment between the donor and both the acceptor and the electrode.1, 2 We studied interfaces with substrates and the fullerene C60, of thin films of prototype low bandgap polymer PCPDTBT, doctor blade casted on substrates with wide span of work functions. We employ X-ray and Ultraviolet photoelectron spectroscopy to investigate interface properties of the pure and F4TCNQ doped polymer. It is found that p-doping can be useful tool for tuning/controling energetics at both polymer interfaces.

References: 1.*Bao, Q. et al. Advanced Materials Interfaces 2015, 2, n/a-n/a. 2.*Yu, S. et al. Applied Physics Letters 2015, 106, 203301.

DS 12.20 Mon 17:00 Poster A

3D conformal deposition of ceramic layers on complex metallic tools and injection molds via chemical vapor deposition — •Tatiana Fedosenko-Becker[1], Friederike Deuerler[1], Gregor Fornalczyk[2], and Frank Mumme[2] — [1]University of Wuppertal, School of Mechanical Engineering and Safety Engineering, Material Technology, Wuppertal, Germany — [2]Gemeinnuetzige KIMW Forschungs-GmbH, Luedenscheid, Germany

Chemical vapor deposition (CVD) is a well-known process to produce high quality thin coatings, such as films with specific properties to protect metallic tools and injection molds from wear, corrosion, and others. However, it can be difficult to obtain a high-performance coating on complicated three-dimensional surfaces of some tools. It needs understanding of the formation of solid material from a gaseous phase, containing complex molecules of volatile matter; research of metalorganic precursors, which decompose at low temperatures (500 °C) and allow the deposition of conformal layers into narrow cracks and holes; and the detailed research of the 3D substrate materials to clarify the influence of the steel alloy on the adhesion of the layers.

The aim of this study is the deposition of CVD layers for three-dimensional zirconia coatings on metallic tools and injection molds. At the present stage of the research the way of deposition and characterization of the coatings on 3D surfaces is developed, the experimental parameters for successful deposition of zirconia layers are found and physical and geometrical properties of the substrate materials are investigated.

DS 12.21 Mon 17:00 Poster A

Scribing of CIGS thin film solar cells with 1550 nm nanosecond laser radiation — •Martin Ehrhardt, Klaus Zimmer, Pierre Lorenz, and Lukas Bayer — Leibniz-Institut für Oberflächenmodifizierung e. V., Permoserstraße 15, 04318 Leipzig, Germany

Microstructuring of thin functional films without affecting the functionality is a great challenging for laser-assisted methods. The laser pattering experiments of copper indium gallium selenide (CIGS) solar cells with a 1.55 μm laser source with a pulse length of 6 ns is present. It will be shown that two different material removal processes were found in dependence on the specific laser parameter used. For high laser repetition rate a material ablation starting from the front side of the samples was observe. By using a low laser repetition rate the laser pulse penetrate the CIGS material and were absorbed in the interface between the CIGS and the Mo causing a delamination lift-off process of the CIGS from the Mo back contact. The morphology and size of the resultant pattern were studied by scanning electron microscopy (SEM). The composition of the sample material after the laser treatment was analyzed by energy dispersive X-ray spectroscopy (EDX) and micro Raman spectroscopy. Furthermore, the different removal processes was simulated using finite element method (FEM) where the laser-solid interaction was approximately described by a heat equation.

DS 12.22 Mon 17:00 Poster A

Magnetoresistance of devices directly written using a focused ion beam — •Vico Liersch[1], Tobias Warnatz[1], Sebastian Wintz[1,2], Gregor Hlawacek[1], Steffen Cornelius[1], Kay Potzger[1], Jürgen Lindner[1], Jürgen Fassbender[1,3], Artur Erbe[1], and Rantej Bali[1] — [1]Helmholtz-Zentrum Dresden-Rossendorf, Deutschland — [2]Paul-Scherrer Institut, Villigen, Schweiz — [3]Technische Universität Dresden, Deutschland

Magnetoresistance (MR) effects are widely studied in multilayered structures, where the current flows perpendicular to the substrate plane. These devices involve complex lithography steps for achieving the required layered structure and electrical contacting. Here we present a different approach, where the magnetic layers are directly embedded onto a current carrying wire template via lateral focused ion beam writing. It is known that ferromagnetism in an ordered (paramagnetic) Fe60Al40 alloy can be induced by ion beam irradiation [1]. We use this phase transition to create a pattern with alternating ferromagnetic and paramagnetic regions [2]. Due to shape anisotropy it is possible to obtain stable states where the neighboring ferromagnetic regions are of either parallel or antiparallel alignment respectively. Respective resistance of parallel or antiparallel alignment states under the influence of a swept magnetic field was observed. First MR measurements of such patterned structures at low temperatures will be shown. [1] J. Fassbender, et al. Physical Review B 77 (2008). [2] R. Bali, et al. Nano letters 14.2 (2014).

DS 12.23 Mon 17:00 Poster A

Magnetoresistance of devices directly written using a focused ion beam — •Vico Liersch[1,2], Tobias Warnatz[1], Sebastian Wintz[1,3], Gregor Hlawacek[1], Steffen Cornelius[1], Kay Potzger[1], Artur Erbe[1], Jürgen Lindner[1], Jürgen Fassbender[1,4], Wieland Zahn[2], and Rantej Bali[1] — [1]Helmholtz-Zentrum Dresden-Rossendorf, Deutschland — [2]Westsächsische Hochschule Zwickau, Deutschland — [3]Paul-Scherrer Institut, Villigen, Schweiz — [4]Technische Universität Dresden, Deutschland

Magnetoresistance (MR) effects are widely studied in multilayered structures, where the current flows perpendicular to the substrate plane. These devices involve complex lithography steps for achieving the required layered structure and electrical contacting. Here we present a different approach, where the magnetic layers are directly embedded into a current carrying planar wire via a focused ion beam. Ferromagnetism in an ordered (initially paramagnetic) $Fe_{60}Al_{40}$ alloy can be induced by ion beam irradiation [1]. We deployed a $\sim$ 2 nm diameter beam of Ne^+ at 20 - 30 keV to induce a pattern with alternating ferromagnetic and paramagnetic stripes in a 40 nm thick $Fe_{60}Al_{40}$ wire [2]. The stripe geometry consisted of two different alternating stripe widths separated by a narrow paramagnetic spacer, and showed a two stepped reversal curve due to parallel and antiparallel magnetization configurations. MR measurements of such patterned structures, with different stripe geometries will be shown. [1] J. Fassbender, et al. Physical Review B 77 (2008). [2] R. Bali, et al. Nano letters 14.2 (2014).

DS 12.24 Mon 17:00 Poster A

Photo-induced dynamics in combined magnonic and phononic multilayer systems — •Markus Müller[1], Dennis Meyer[1], Henning Ulrichs[1], Maria Mansurova[1,3], Florian Döring[2], Jakob Walowski[3], and Markus Münzenberg[3] — [1]I. Physikalisches Institut Georg-August Universität, Göttingen, Germany — [2]Institut für Materialphysik Georg-August Universität, Göttingen, Germany — [3]Physikalisches Institut Ernst Moritz Arndt Universität, Greifswald, Germany

We present investigation of elastic dynamics in periodic and aperiodic thin film multilayers. In particular we discuss dynamics in samples combining alternating layers of tungsten and polycarbonate, grown by pulsed laser deposition. Experiments were carried out by means of time-resolved all-optical pump-probe spectroscopy. The findings are supported by simulations, and suggest the possibility to block a wide range of phonons. Downscaling of the design principle should enable the realization of a thermally insulating medium.

Further functionalization was obtained by incorporating ferromagnetic layers. We discuss how magneto-elastic coupling can be exploited in order to excite spin waves simultaneously with the elastic modes.

DS 12.25 Mon 17:00 Poster A

Elastic dynamics in CoFeB/MgO multilayers: Excitation and suppression of THz phonons — •Dennis Meyer[1], Markus Müller[1], Henning Ulrichs[1], Maria Mansurova[1,2], Jakob Walowski[2], and Markus Münzenberg[2] — [1]I. Physikalisches Institut, Georg-August Universität Göttingen — [2]Institut für Physik, Ernst Moritz Arndt Universität Greifswald

When thin films are impinged by a laser pulse, the thermal stress induced at the surface triggers coherent elastic waves which subsequently propagate through the sample. We present a combined experimental and numerical investigation of such dynamics in a CoFeB/MgO multilayer. Experiments were carried out by time-resolved pump-probe spectroscopy. The main finding is the appearance of a 0.5 THz phonon

mode, which is a Bloch-like eigenmode of the system. By breaking the translational symmetry of the superlattice, this mode can be effectively suppressed. These findings are supported by numerical simulations, which in addition provide spatial information inaccessible by experiment. Besides being a building block for photo-induced THz phononics, we will discuss in how far such phonon blocking structures can be utilized for controlling heat flow in thin films.

DS 12.26 Mon 17:00 Poster A

Tunnel diodes—A method to picture quantum correlations in disordered tellurides — Dominik Gholami Bajestani[1], •Henrik Padberg[1], Tobias Schäfer[1], and Matthias Wuttig[1,2] — [1]I. Physikalisches Institut (IA), RWTH Aachen University, 52056 Aachen, Germany — [2]JARA-FIT, RWTH Aachen University, Germany

Phase change materials (PCMs) are promising candidates for a new generation of fast and non-volatile memories unifying flash and DRAM properties. Besides the fast electrical (or optical) switching between amorphous and crystalline phase, storage of additional information in the crystalline state becomes possible because of the resistivity being tunable over several orders of magnitude. The variation of the resistivity stems from different degrees of disorder in the PCM and is linked to quantum correlations. Both effects are known to alter the density of states (DoS). A method to measure the DoS are tunnel diodes, which make use of the tunnel effect and consist of a layer stack with a metal and the PCM separated by a thin oxide layer.

In this study, we investigate changes in disorder and quantum correlation in the PCM $Sn_1Sb_2Te_4$ (SST) using tunnel diodes. As magnetron-sputtering and subsequent annealing are the best way to control the PCM's disorder, we have developed an in situ sputter process to guarantee a high quality layer stack. Besides characterization studies of the diodes, the DoS of SST has been examined for different annealing states to link band structure phenomena to the material properties. To probe the DoS ($\propto \frac{dI}{dV}$), an AC-voltage signal is applied to a biased tunnel diode, at liquid helium temperatures.

DS 12.27 Mon 17:00 Poster A

Nanoparticle gradient composites for resistive switching — •Alexander Vahl[1], Julian Strobel[2], Thomas Strunskus[1], Lorenz Kienle[2], and Franz Faupel[1] — [1]Christian-Albrechts University at Kiel, Institute for Materials Science, Chair for Multicomponent Materials, Kaiserstr. 2, 24143, Kiel, Germany — [2]Christian-Albrechts University at Kiel, Institute for Materials Science, Chair for Synthesis and Real Structure of Solids, Kaiserstr. 2, 24143, Kiel, Germany

Resistive Switching has been reported in various material systems and recently attracted increasing attention. Composite materials comprising of a gradient of nanoparticles within an insulating matrix are of particular interest for analog resistive switching without filament formation. In focus of this work is the preparation (DC magnetron quasi-cosputtering) and morphological examination of vertical gradients of silver nanoparticles in an amorphous silicon matrix for further investigation of resistive switching. The silver nanoparticles were either formed by self-organization onto the surface or within a gas aggregation cluster source. Deposition time evolution of self-organization of nanoparticles was studied by TEM and compared to nanoparticles generated by gas aggregation cluster source. Nanocomposite samples were characterized by TEM, SEM, Raman spectroscopy and electrical hysteresis measurements. Electron diffraction shows polycrystalline silver nanoparticles and amorphous silicon matrix. SEM cross section images indicate the successful formation of nanoparticle gradients.

DS 12.28 Mon 17:00 Poster A

Using direct laser writing for photonic crystal structures in nanocrystal solar cells — •Stephan Dottermusch[1], Aina Quintilla[2], Guillaume Gomard[2], and Bryce Richards[1,2] — [1]Institut für Mikrostrukturtechnik (IMT), Karlsruher Institut für Technologie (KIT), Karlsruhe, Deutschland — [2]Lichttechnisches Institut (LTI), Karlsruher Institut für Technologie (KIT), Karlsruhe, Deutschland

In recent years light trapping in thin-film solar cells using photonic crystal (PC) based structures has found an increasing interest. Many different types of textures and structures have been proposed. Whereas the fabrication of 1D and 2D PCs has been shown using conventional top-down etching methods or bottom-up self-assembly methods, 3D PCs are rarely seen do to a lack of fabrication techniques. Direct laser writing (DLW) is an emerging technology with the capacity of 3D structuring polymers on a sub-micrometer scale. In this work, PCs were created using DLW and infiltrated with CIS nanocrystals. Light trapping in these structures was investigated using simulations, and observed by measuring the absorption spectrum. Absorption peaks were identified by comparing the spectrum of a flat reference layer.

DS 12.29 Mon 17:00 Poster A

Investigation of thermoelectric properties of thin film chalcogenides — •Matteo Cagnoni[1] and Matthias Wuttig[1,2] — [1]Physikalisches Institut (IA), RWTH Aachen University, 52056 Aachen, Germany — [2]JARA-FIT, RWTH Aachen University, Germany

Future strategies for energy supply are going to demand an increasing use of renewable, clean and sustainable energy sources. The chance of recycling waste heat through thermoelectric generators and the employment of solid-state Peltier coolers in refrigerators are very attractive. Therefore, the interest of the scientific community into thermoelectric properties of materials has experienced a continuous revival from the 90s, after the proof that high efficiencies can be obtained.

The finding of new high-efficiency thermoelectric materials, characterized by large Seebeck coefficients and high electrical conductivity, and small thermal conductivity, is a very difficult task because of the interplay of a multitude of different physical phenomena that govern thermoelectric behavior. Research driven by physical intuition and trial and error has allowed placing materials classes such as sketterudites and chalcogenides in the Olympus of thermoelectrics.

In this project, the behavior of thin film chalcogenides has been investigated in relation to stoichiometric and structural changes, in order to unravel the link between physical properties and thermoelectric performances.

DS 12.30 Mon 17:00 Poster A

Thermal Transport of Phase Change Materials and related Chalcogenides — •Daniel Führen[1], Matteo Cagnoni[1], and Matthias Wuttig[1,2] — [1]I. Physikalisches Institut (IA), RWTH Aachen University, 52056 Aachen, Germany — [2]JARA-FIT, RWTH Aachen University, Germany

Phase change materials (PCMs) are a unique class of materials combining interesting physical properties such as large electronic and optical contrast between the amorphous and crystalline states. One remarkable feature of those materials is the fast reversible switching between their states on a timescale of nanoseconds. This combination of properties is used to store information in rewritable optical data storage applications. The chalcogenide GeTe was the first investigated PCM which shows good optical contrast and fast recrystallization. Many compositions with Ge have been found as PCMs and are applied in commercial products like rewritable DVDs.

Thermal properties of materials play an important role for an efficient switching behavior between the two states. PCMs may be promising candidates for thermoelectric devices because of their specific characteristic of low thermal conductivity in the crystalline state. Here, we present thermal properties of phase change alloys measured between room temperature and 120 °C. The samples are produced as thin films via sputter deposition and are analyzed by 3-omega technique, which has a high accuracy and applicability in a large temperature range, to determine the thermal conductivity.

DS 12.31 Mon 17:00 Poster A

Thermal Electron Emission from LaB_6 und BaO in a Thermionic Set-Up — •Michael Hohage[1], Michael Schneiderbauer[2], Mariella Denk[1], Anna Steiner[1], Markus Gusenbauer[1], and Peter Zeppenfeld[1] — [1]Institut für Experimentalphysik, Abt. für Atom- und Oberflächenphysik, Johannes Kepler Universität Linz, Altenbergerstraße 69, 4040 Linz, Austria — [2]te+, Quellenweg 33, 4203 Altenberg, Austria

Thermionic emission is a promising approach to convert heat into electric energy at temperatures reached by burning wood or fossil fuels. We have studied the electron emission from the materials LaB_6 and BaO at temperatures up to 1550 K. The cathode and anode surfaces are coplanar for the purpose of a systematic study of the electron emission yield as a function of distance. The electrode temperatures are measured by thermocouples and an infrared pyrometer.

We show the dependence of the thermionic emission current on temperature, distance and on the activation procedure of the BaO electrode. A simple model of the magnitude of the space charge and its influence on thermal electron emission will be introduced. Concepts to lower the space charge and its effect on the thermal emission will be presented and tested against simulations and experiments. In par-

ticular, the role of the geometry and macrostructure of the electrodes as well as the influence of external electric and magnetic fields will be discussed.

DS 12.32 Mon 17:00 Poster A

Thermal Characterisation of Ultrathin Complex Oxide Multilayers by the 3ω-Method — •Patrick Thiessen[1], Felix Rieger[1], Vladimir Roddatis[1], Immo Bahns[1], Christian Jooss[1], Oleg Shapoval[2,3], Alexandr Belenchuk[2,3], and Vasily Moshnyaga[2] — [1]Institut für Materialphysik, Universität Göttingen — [2]1. Physikalisches Institut, Universität Göttingen — [3]Institute of Applied Physics,Chisinau(Republic of Moldova)

The present work evaluates the thermal conductivity of ultrathin complex oxide superlattices. Three different deposition methods - Metal Aerosol Deposition (MAD), Pulsed Laser Deposition (PLD) and Ion Beam Sputtering (IBS) - were used to epitaxially grow periodic superlattices consistent of $La_{0.7}Sr_{0.3}MnO_3$ (LSMO) and $SrTiO_3$ (STO) respectively $Pr_{0.7}Ca_{0.3}MnO_3$ (PCMO) and STO on STO(100) substrates with varying individual layer thickness and number of layers. The goal of this work was to investigate the influence of the interfaces in dependence of the superlattice periodicity on the thermal conductivity - i.e. the phonon propagation and scattering. The manganite-STO system serves as a model system for acoustic impedance missnatch (AIM) due to the high difference in its elastic properties and its good epitaxial grow. XRay- and TEM-studies are included in order to distinguish between interface related effects and changes in the lattice strain or in the point defect density.

DS 12.33 Mon 17:00 Poster A

In-plane thermal conductivity of thin films measured by steady-state infrared thermography — •Anton Greppmair[1], Caroline Gerstberger[1], Benedikt Stoib[1], Nitin Saxena[2], Peter Müller-Buschbaum[2], Martin Stutzmann[1], and Martin S. Brandt[1] — [1]Walter Schottky Institut and Physik-Department, Technische Universität München, Am Coulombwall 4, 85748 Garching, Germany — [2]Lehrstuhl für Funktionelle Materialien, Physik-Department, Technische Universität München, James-Franck-Strasse 1, 85748 Garching, Germany

We demonstrate a simple and quick method for the measurement of the in-plane thermal conductance of thin films via steady-state IR thermography. The films are suspended above a hole in an opaque substrate and heated by a homogeneous visible light source. The temperature distribution of the thin films is captured via infrared microscopy and fitted to the analytical expression obtained for the specific hole geometry in order to obtain the in-plane thermal conductivity. For thin films of poly(3,4-ethylenedioxythiophene):polystyrene sulfonate post-treated with ethylene glycol and of polyimide we find conductivities of $1.0\,\mathrm{W/(m\,K)}$ and $0.3\,\mathrm{W/(m\,K)}$ at room temperature, respectively. These results are in very good agreement with literature values, validating the method developed.

DS 12.34 Mon 17:00 Poster A

Improving Thermoelectric Performance of TiNiSn by insertion of NiMnSb in the Half Heusler Structure — •Tanya Berry, Siham Ouardi, and Claudia Felser — Max Planck Institute for Chemical Physics of Solids, Dresden, Germany.

TiNiSn n-type semiconductors are promising thermoelectric material due to their high power factor. TiNiSn and NiMnSb are Half Heusler alloys that are economic and in high abundance in nature. In this work, we improved the thermoelectric properties of TiNiSn by insertion of NiMnSb in the Half Heusler Structure. The samples were prepared using arc melting technique. As caste and annealed samples were characterized using powder X-ray diffraction patterns, energy-dispersive X-ray spectroscopy, and differential scanning calorimetry to determine the phases and microstructure of the samples. Full Heusler phases were observed in samples with higher substitution amount of NiMnSb. Compared to TiNiSn, the power factor of substituted compounds is enhanced and the thermal conductivity is reduced. Further results will be discussed in the poster.

DS 12.35 Mon 17:00 Poster A

Relation between the symmetry of diperiodic atomic crystals and the existence of Dirac cones in their energy spectrum — •Vladimir Damljanovic and Rados Gajic — Institute of Physics Belgrade, Belgrade, Serbia

We have determined [1] sufficient conditions for the appearance of s=1/2 Dirac cones in any diperiodic, non-magnetic atomic crystal in which the spin-orbit coupling is negligible. Our group theoretical analysis of all 80 diperiodic groups, shows that combined time-reversal and crystal symmetry allows the existence of Dirac cones in the vicinity of K-points in the Brillouin zone, for systems belonging to certain hexagonal diperiodic groups. We have illustrated our results by a tight-binding example.

[1] V. Damljanović, R. Gajić: "Existence of Dirac cones in Brillouin zone of diperiodic atomic crystals according to group theory", arXiv: 1510.09065v1

DS 12.36 Mon 17:00 Poster A

Atomic layer engineering of tunnel barriers in manganite based spin valves — •Vitaly Bruchmann-Bamberg[1], Vasily Moshnyaga[1], Alexander Belenchuk[2], and Oleg Shapoval[2] — [1]I. Physikalisches Institut, Universität Göttingen, Friedrich-Hund-Pl. 1, 37077 — [2]IIEN, Academy of Science of Republic, Moldova, Academia 3/3, MD-2028 Chinisau, Republic of Moldova

We have prepared $La_{0.7}Sr_{0.3}MnO_3$ (LSMO)-electrode based spin valves by means of metalorganic aerosol deposition. $SrTiO_3$ (STO) is a well-known insulator used as a tunnel barrier and for magnetic decoupling of both electrodes. Unfortunately, it creates so called dead layers at the valence-mismatched interface to LSMO, reducing the tunnel magnetoresistance significantly [1]. In order to improve the interface by following recent reports [2], atomic layer deposition of interfacial SrO similar to Ruddlesden Popper STO as well as other manganite insulators as tunnel barriers were examined.

[1] H. Yamada et al., Science 305, 646 (2004).
[2] M. Matvejeff et al., Appl. Phys. Lett. 107, 141604 (2015).

DS 12.37 Mon 17:00 Poster A

Growth of continuous hexagonal boron nitride on smooth Ni films — •Siamak Nakhaie, Joseph M. Wofford, Manfred Ramsteiner, Carsten Pfüller, Marcelo J. Lopes, and Henning Riechert — Paul-Drude-Institut für Festkörperelektronik, Berlin, Germany

Hexagonal boron nitride (h-BN) has recently been the subject of an extensive ongoing research effort. This has in large part been driven by the suitability of h-BN for integration into heterostructures with other 2-dimensional materials, such as graphene [1]. However, a scalable synthesis method which combines high-crystalline quality with absolute thickness control remains elusive. We report the synthesis of atomically thin, continuous h-BN on smooth crystalline Ni films using molecular beam epitaxy (MBE). The presence of well-ordered, crystalline h-BN films on Ni (which were grown on MgO(111) substrates) was confirmed using Raman spectroscopy, which revealed a sharp and narrow optical-phonon peak at 1361 cm^{-1}. The width of the Raman peak of the MBE grown h-BN is comparable to that obtained from single-crystalline mechanically exfoliated h-BN. The ubiquity of wrinkle structures in numerous atomic force microscopy scans, together with the uninterrupted observation of the h-BN Raman signal, offer strong evidence that the h-BN films are continuous. Furthermore, the smoothness of the Ni surface allowed for a detailed morphological study of the grown h-BN. This includes the observation of h-BN buckling even on single atomic steps of the underlying Ni. [1] C.R. Dean et al., Nat. Nanotechnol. 5 (2010) 722

DS 12.38 Mon 17:00 Poster A

Resistive switching phenomenon and hole wind effect in YBCO thin films — Martin Truchly[1], •Elena Zhitlukhina[2], and Tomas Plecenik[1] — [1]Department of Experimental Physics, Comenius University, 84248 Bratislava, Slovak Republic — [2]Donetsk Institute for Physics and Engineering, 03680 Kyiv, Ukraine

We present an overview of our experimental and theoretical activities aimed to clarify the mechanism of resistive memory effects in YBCO thin layers. The phenomenon was studied by scanning spreading resistance microscopy (SSRM) and scanning tunneling microscopy (STM) techniques. The most striking feature uncovered (in contrast to previous experiments on planar bilayers with YBCO films) was the opposite voltage-bias polarity of the switching effect in all SSRM and a number of STM measurements. Observed hysteresis in current-voltage characteristics is interpreted as a movement of oxygen vacancies in the vicinity of the tip-YBCO contact. Since the charge distribution in YBCO samples is expected to be strongly inhomogeneous, the balance between the direct electrostatic force on activated oxygen ions and that caused by momentum exchange with the current carriers (holes) hitting them determines direction in which the oxygen vacancies are moving.

We propose a minimalist model with the only fitting parameter that accounts for the resistance hysteresis phenomenon in the YBCO films studied.

DS 12.39 Mon 17:00 Poster A

MgO barrier parameter and TMR of PLD grown magnetic tunnel junctions with zinc ferrite electrodes — •Michael Bonholzer, Daniel Splith, Michael Lorenz, and Marius Grundmann — Universität Leipzig, Institut für experimentelle Physik II, Linnéstr. 5, 04103 Leipzig

We built zinc ferrite ($ZnFe_2O_4$) based magnetic tunnel junctions (MTJs) with an epitaxial MgO barrier and investigated their electrical properties.
A multilayer of TiN/$ZnFe_2O_4$/MgO/Co was deposited on (100)-MgO substrates by PLD. MTJs, lateral size ranging from 5×5 to $30\times30\,\mu m^2$, were defined by argon ion etching. A high quality, epitaxial TiN layer [1] is used to reduce series resistance. RHEED intensity oscillations, visible during PLD-growth of MgO, show the high structural quality of the barrier and allow an accurate determination of barrier thickness. With that, other barrier parameters were determined out of I-V measurements by a modified BDR-model [2]. Since the original BDR-model neglects the influence of lateral thickness variations, we introduced the barrier roughness as new parameter modelled by a Gaussian distribution of thickness and fixed the mean thickness to the value determined by RHEED. The new model gives reasonable values for roughness and height of the MgO barrier.
Magnetic field-dependent resistance measurements carried out on these structures show a TMR of 1% at 200 K.
[1] M. Bonholzer *et al.*, Phys. Status Solidi A **211**, 2621 (2014)
[2] W.F. Brinkman *et al.*, J. Appl. Phys. **41**, 1915 (1970)

DS 12.40 Mon 17:00 Poster A

Investigations of defects in weakly damaged ion implanted GaAs — •Sascha Creutzburg[1], Emanuel Schmidt[1], Ingo Uschmann[2], and Elke Wendler[1] — [1]Institut für Festkörperphysik, Friedrich-Schiller-Universität Jena, Max-Wien-Platz 1, 07743 Jena — [2]Institut für Optik und Quantenelektronik, Friedrich-Schiller-Universität Jena, Max-Wien-Platz 1, 07743 Jena

In case of room temperature ion implantation of GaAs, a saturation of defects at a rather low level without amorphization is observed, the microstructure of which is not yet understood. The aim of the present work is to investigate this state of weak damage in GaAs by RBS-channelling, optical, TEM, XRD and in-situ stress measurements. Undoped <100> oriented GaAs wafers were implanted with 1 MeV Si^+ at room temperature to ion fluences between $1\cdot10^{13}$ cm^{-2} and $3\cdot10^{15}$ cm^{-2} with constant ion flux. The energy dependence of the minimum yield as measured by RBS-channelling indicates the presence of correlated displaced atoms. This is in agreement with previously performed temperature dependent RBS-channelling measurements. The near edge absorption coefficient K shows an exponential behaviour of the photon energy $\hbar w$ according to $K \sim \exp(\hbar w/E)$ with the tailing energy $E = (0.36 - 0.51)$ eV depending on the ion fluence. Theoretical considerations have shown that the range of tailing energy can be explained assuming a high concentration of antisite defects and vacancies. Further information about lattice strain within the implanted layers will be obtained by ex-situ XRD rocking curve measurements and by in-situ measurements of the sample curvature.

DS 12.41 Mon 17:00 Poster A

Secondary Ion Mass Spectrometry (SIMS) in Helium and Neon Ion Microscopy — David Dowsett, •Florian Vollnhals, Jean-Nicolas Audinot, and Tom Wirtz — Advanced Instrumentation for Ion Nano-Analytics (AINA), MRT Department, Luxembourg Institute of Science and Technology (LIST), 41 rue du Brill, L-4422 Belvaux, Luxembourg

Helium Ion Microscopy (HIM) was introduced a few years ago as an imaging tool with a lateral resolution below 1 nm. The addition of Neon as a working gas in the Orion NanoFab (Zeiss) has opened up new possibilities in high resolution nano-machining and FIB applications.

We developed instrumentation to combine the HIM with Secondary Ion Mass Spectrometry (SIMS). In SIMS, the sample is sputtered by a primary beam, e.g., the highly focused He or Ne ion beam of a HIM, while the secondary ion emission is recorded. This combination takes advantage of both probe size of the He/Ne beam and sensitivity of the SIMS analysis, allowing for high resolution correlative microscopy. In addition, the HIM-SIMS combination has very promising prospects regarding in-situ process control during nano-machining.

We will discus instrumental and method development, including theoretical and experimental aspects, e.g., He and Ne ion beam interaction with sample surfaces.[1] He and Ne ion beams will be shown to be viable primary species for successful imaging SIMS, approaching the physical resolution limits of <20 nm.[2]
[1] D. Dowsett et al., J. Vac. Sci. Technol. B 30 (2012), 06F602
[2] T. Wirtz et al., Nanotechnology 26 (2015), 434001

DS 12.42 Mon 17:00 Poster A

Implementation of a setup for ion energy and ion mass selective hyperthermal ion-beam assisted deposition of ultrathin nitride films — •Philipp Schumacher[1], Jürgen W. Gerlach[1], Stephan Rauschenbach[2], and Bernd Rauschenbach[1] — [1]Leibniz-Institut für Oberflächenmodifizierung, Leipzig — [2]Max-Planck-Institut für Festkörperforschung, Stuttgart

Ion-beam assisted deposition (IBAD) is a widely used deposition technique to produce high-quality thin films of different kind. For this study, an already existing system for hyperthermal nitrogen ion-beam assisted molecular-beam epitaxy (IBA-MBE) of GaN was equipped with a quadrupole mass filter setup in order to perform the deposition process with ions of a certain preselected mass (N^+ or N_2^+) as well as with a preselected kinetic ion energy in the hyperthermal energy range up to about 100 eV. This way, the influence of the ion species on the growth process of GaN and on the properties of the produced ultrathin films can be investigated. The respective influence of the kinetic energy of the ions is to be studied as well. Here, the quadrupole setup in combination with a hollow-anode plasma-source is described and its performance is presented. Mass separation is demonstrated and the relevant properties of the ion beam, such as ion energy distribution, ion current density distribution and ion beam profile, are presented in regard to ion-beam assisted film growth. Finally, preliminary results on GaN film deposition by applying this setup are shown.

DS 12.43 Mon 17:00 Poster A

Intense Electrospray Ionization Sources/Atmospheric Pressure Interfaces for Ion Beam Deposition — •Stephan Rauschenbach[1], Laurent Bernier[2], Matthias Pauly[3], and Julius Reiss[2] — [1]Max-Planck-Institute for Solid State Research, Stuttgart, Germany — [2]Technical University Berlin, Germany — [3]University Strasbourg, ICS-CNRS, France

Reactive or soft-landing molecular ion beam deposition requires high fluence ion beams, which present soft ionization sources, such as electrospray ionization (ESI), cannot deliver. In principle, electrospray ionization can generate ion currents in the microamp range, however, the ion transport in the atmospheric interface, i.e. the transfer of ions trough a capillary or pinhole from atmospheric pressure to vacuum, is extremely inefficient. The particle transport is governed by electric forces, diffusion and by the flowing background gas. The gas flow can be laminar or turbulent and is strongly compressible. Its interplay with ions can strongly influence the efficiency of the source, which is however not fully understood. We present the experimental and numerical analysis of the ion transport behavior in a confined, flowing gas and show that highly efficient ion sources can be conceived.

DS 12.44 Mon 17:00 Poster A

Phase transition of pulsed laser deposition-deposited $Ge_2Sb_2Te_5$ films induced by nano- and femtosecond single laser pulse irradiation — •Xinxing Sun[1], Martin Ehrhardt[1], Andriy Lotnyk[1], Erik Thelander[1], Jürgen W. Gerlach[1], Tomi Smausz[2], Ulrich Decker[1], and Bernd Rauschenbach[1,3] — [1]Leibniz Institute of Surface Modification, Permoserstr. 15, D-04318, Leipzig, Germany — [2]University of Szeged, Dóm tér 9. H-6720 Szeged, Hungary — [3]Institute for Experimental Physics II, Leipzig University, Linnéstr.5, D-04103 Leipzig, Germany

Fast phase transformation of $Ge_2Sb_2Te_5$ (GST) materials is a vital requirement for devices based on phase change materials. In this present work, the crystallization process of pulsed laser deposition (PLD)-deposited GST films irradiated by nano- and femtosecond single pulses at a wavelength of 248 nm with varied laser fluences is compared. Detailed structural information about the phase transformation is elucidated by x-ray diffraction and high resolution transmission electron microscopy (TEM). A high optical reflectivity contrast (25%) between amorphous and completely crystallized GST films was achieved by fs laser single pulse irradiation induced at a fluence between 13 and 16 mJ/cm^2 and by ns laser single pulse irradiation induced at a fluence between 67 and 130 mJ/cm^2. Finally, the fluence dependent increase

of the reflectivity is discussed in terms of each photon involved into the crystallization process for ns and fs pulses, respectively.

DS 12.45 Mon 17:00 Poster A

Electronic Tuning in Phase Change Materials using Ionic Liquid Gating — •Bo Thöner, Hanno Volker, Tobias Schäfer, Peter Jost, Artur Romanov, and Matthias Wuttig — I. Physikalisches Institut (IA), RWTH Aachen University

Phase change materials (PCM), which are renowned for their pronounced optical and electrical property changes upon crystallization, receive renewed interest because of their potential applications in novel electronic storage devices.

Since disorder strongly affects their properties, PCMs are an obvious choice to examine the competing impact of electron correlation and disorder-induced localization, which both can explain metal-insulator transitions (MITs). In the scope of Anderson's theory, the MIT is achieved by moving the so-called mobility edge with respect to the Fermi energy. On the one hand, the mobility edge can be shifted by thermal annealing. On the other hand, it is reasonable to assume that a transition due to a shift of the Fermi energy by applying an electric field is also possible. This could allow for a more precise and reversible crossing of the MIT and a better understanding of the process. Hence, we have investigated the feasibility of using ionic liquid gating as a method to induce the MIT.

The use of ionic liquids as the gating electrolyte enables a potentially larger number of induced charge carriers compared to conventional gating which increases the range in which the Fermi energy can be shifted.

DS 12.46 Mon 17:00 Poster A

Spectroscopic near-field investigation of trigonally symmetric contrasts on solvothermally grown Sb_2Te_3 platelets in the mid-infrared. — •Lars Mester[1], Martin Lewin[1], Tobias Saltzmann[2], Ulrich Simon[2], and Thomas Taubner[1] — [1]I. Physikalisches Institut A, RWTH Aachen — [2]Institut für Anorganische Chemie, RWTH Aachen

Chemical syntheses could provide a cheap alternate approach to conventional nanofabrication as e.g. gas-phase deposition techniques [1]. Solvothermally synthesised Sb_2Te_3 platelets of $2-3\,\mu m$ size grown under various synthesis conditions are spectroscopically investigated via scanning near-field microscopy (SNOM) at various mid-infrared wavelengths. In SNOM measurements, laser light is focused on an AFM tip which is scanned in tapping mode over the sample. Backscattered light from the tip is influenced by near-fields of the sample and enables microscopy and spectroscopy beyond the diffraction limit with lateral resolution in the order of the AFM tip radius ($\approx 25\,nm$) [2].

The investigated single-crystalline Sb_2Te_3 platelets show unexpected domains of several 100 nm lateral extent with different optical response. By modeling the response with the Drude model and Finite Dipole Model, Hauer *et al* attributed the domains to regions of two different charge carrier concentrations [3]. Further analysis of the Drude characteristics is made with SNOM spectroscopy between $900-1900\,cm^{-1}$.

[1] Saltzmann et al, Angew. Chem. Int. Ed. 54, pp. 6632-6636 (2015)

[2] Taubner et al, J. of Microsc., 210, Pt 3, pp. 311-314 (2003)

[3] Hauer et al, Nano Lett. 15, pp. 2787-2793 (2015)

DS 12.47 Mon 17:00 Poster A

Spectroscopic near-field investigation of trigonally symmetric contrasts on solvothermally grown Sb_2Te_3 platelets in the mid-infrared. — •Lars Mester[1], Martin Lewin[1], Tobias Saltzmann[2], Ulrich Simon[2], and Thomas Taubner[1] — [1]I. Physikalisches Institut A, RWTH Aachen — [2]Institut für Anorganische Chemie, RWTH Aachen

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[3] Hauer et al, Nano Lett. 15, pp. 2787-2793 (2015)

DS 12.48 Mon 17:00 Poster A

Characterization of Ta_2O_5 and $BaTiO_3$ based memristive systems — •Lauritz Schnatmann[1], Norman Shepheard[1], Stefan Niehörster[1], and Andy Thomas[1,2] — [1]Center for Spinelectronic Materials and Devices, Physics Department, Bielefeld University, Germany — [2]IFW Dresden, IMW, Helmholtzstrasse 20, 01069 Dresden, Germany

We prepared thin film resistive tunnel junctions based on Ta_2O_5 and $BaTiO_3$ by magnetron sputtering and defined the junctions by optical lithography in sizes between 10 μm and 25 μm. We looked into the memristive switching behaviour based on Chua et al. [1], where he theoretically described it in 1976. He predicted the change of the switching with a variation of the measurement frequencies. To do this, we read out the current at a fixed bias voltage during a whole loop.

Di Ventra et al. [2] described two different types of memristors: Type I and type II. These two types show a crossing or non-crossing behavior at 0 V in the hysteresis loop and we observed these two types of switching in the different systems. For the hysteresis loops, we chose frequencies from 0.006 mHz to 2 mHz and maximum amplitudes from 150 mV up to 325 mV and compared the amplitudes of the resistance change.

[1] Chua et al. 'memristive devices and systems', Proceedings of the IEEE, 64, 209-223, 1976

[2] Yuriy V Pershin and Massimiliano Di Ventra 'Memory effects in complex materials and nanoscale systems', Advances in Physics, 60, 145-227, 2011

DS 12.49 Mon 17:00 Poster A

Molecular Dynamics Approach to Resistive Switching in Thin Film Systems — •Tobias Gergs, Sven Dirkmann, Frederik Schmidt, and Thomas Mussenbrock — Ruhr University Bochum, 44780 Bochum

Resistive switching devices have recently experienced a revival, leading to a remarkable enhancement of the scientific interest due to a wide range of potential applications including non-volatile memories and neural networks. Most of these devices rely on ionic conduction mechanisms. Here the change in resistance is due to the formation and dissolution of electrically conducting paths in solid state electrolytes. This phenomenon is also referred to as electrochemical metallization or metallic bridging. It has recently been shown that kinetic Monte Carlo simulations are capable of mimicking the long time scale dynamics of such devices by imposing potential structures as well as activation energies for the chemical processes. This contribution is devoted to study the short time scale dynamics of a generic Cu/a-SiO_2/Cu tri-layer thin film system and its fundamental properties by means of molecular dynamics simulations. Particularly, the influence of an externally applied electric field on the interfacial molecular configuration is discussed. (The work is supported by the German Research Foundation in the frame of FOR 2093.)

DS 12.50 Mon 17:00 Poster A

Impact of disorder on properties of phase change materials — •Felix vom Bruch, Strefan Jakobs, and Matthias Wuttig — I. Physikalisches Institut (IA), RWTH Aachen University,52056 Aachen, Germany

Phase change materials (PCM) combine unique physical properties. They develop a high optical and electrical contrast between their amorphous and crystalline phase. Moreover switching between both states occurs on a nanosecond timescale. The pronounced optical contrast is related to a change in bonding mechanism upon crystallization. The amorphous phase is governed by conventional covalent bonds whereas the crystalline phase is characterized by the formation of resonant bonds [1]. Moreover, in many PCM chemical disorder on the cation sublattice strongly affects electrical properties [2]. Annealing of the material leads to a subsequent reduction of this disorder and finally to a phase transformation. Here we explore the impact of structural and stoichiometric disorder on the properties of phase-change thin films. The samples are deposited using sputter deposition and are subsequently characterized by means of X-ray diffraction, van-der-Pauw

measurements and Fourier transform infrared spectroscopy.

[1] Shportko, K., *et al.* Resonant bonding in crystalline phase change materials. Nature Materials (2008) 653-658.

[2] Siegrist, T., *et al.* Disorder-induced localization in crystalline phase-change materials. Nature Materials (2011) 202-208.

DS 12.51 Mon 17:00 Poster A

Designing new Phase Change Materials via Stoichiometry — •Stefan Jakobs[1], Alexander von Hoegen[1], and Matthias Wuttig[1,2] — [1]I. Physikalisches Institut (IA), RWTH Aachen University, 52056 Aachen, Germany — [2]JARA - Fundamentals of Future Information Technology, RWTH Aachen University, Germany

Phase change media utilize a remarkable property portfolio including the ability to rapidly switch between the amorphous and crystalline state, which differ significantly in their properties. This material combination makes them very attractive for data storage application in rewriteable optical data storage, where the pronounced difference of optical properties between the amorphous and crystalline state is used [1] . This unconventional class of materials is also the basis of a storage concept to replace flash memory. This poster will discuss the unique material properties, which characterize phase change materials. In particular, it will be shown that only a rather small group of materials utilizes resonant bonding, a particular flavour of covalent bonding, which can explain many of the characteristic features of phase change materials. This insight is employed to predict systematic property trends and to explore the limits in stoichiometry for such memory applications. It will be demonstrated how this concept can be used to tailor the electrical and thermal conductivity of phase change materials.

[1] Wuttig, M. and Yamanda, N. *Nature materials* **6**(11), 824-832 (2007)

DS 12.52 Mon 17:00 Poster A

Ion transport in memristive double barrier devices — •S. Dirkmann[1], J. Trieschmann[1], T. Gergs[1], E. Solan[2], M. Hansen[3], M. Ziegler[3], K. Ochs[2], H. Kohlstedt[3], and T. Mussenbrock[1] — [1]Ruhr-Universität Bochum, Theoretische Elektrotechnik, 44780 Bochum — [2]Ruhr-Universität Bochum, Digitale Kommunikationssysteme, 44780 Bochum — [3]Christian-Albrechts-Universität Kiel, Nanoelektronik, 24143 Kiel

The memristive double barrier device is an ultra-thin four-layer system ($Nb/Al/Al_2O_3/Nb_xO_y/Au$). Here the memristive layer (Nb_xO_y) is sandwiched between a Schottky and a tunneling barrier. It has been recently shown that this device offers a number of potentially interesting features [1]: An intrinsic current compliance, improved retention, and – most importantly – no need for an initial electric forming procedure. The latter is particularly attractive for applications in highly dense random access memories or neuromorphic mixed signal circuits. So far a deeper physical understanding of the interplay between the current transport mechanism and inner atomistic device structure is missing. In this contribution, we report on results of kinetic Monte-Carlo simulations of the transport phenomena in these devices. We identify the ion drift of charged point defects within the Nb_xO_y layer as a key factor for the resistive switching behavior. We discuss the related current-voltage characteristics which are in excellent agreement with experimentally obtained data. (The work is supported by the German Research Foundation in the frame of FOR 2093.)

[1] M. Hansen et al., Scientific Reports **5**, 13753 (2015)

DS 12.53 Mon 17:00 Poster A

Temperature-driven phase transition in $V_{1-x}Mo_xO_2$ thin films: Interplay of Structural and Electronic Transitions — Sven Esser, Sebastian Merten, Christoph Meyer, and •Vasily Moshnyaga — I. Physikalisches Institut, Georg-August- Universität Göttingen, Friedrich-Hund-Platz 1, 37077 Göttingen

VO_2 with a metal-insulator transition (MIT) at 340 K and resistivity change by 3-4 orders of magnitude [1] is a promising candidate for fast switching devices. In the same temperature regime a structural phase transition (SPT) from monoclinic structure to rutile [2] also occurs. Both phase transitions could be driven quasi optically, which opens the possibility as fast optical switches (FOS)[2].

Due to several doping values different crystal structures (R, M1, M2, T [3]) of VO_2 can be stabilized at room temperature. For high quality films of definite composition a precise control of the Mo-content during preparation is necessary.

We report the growth of epitaxial $V_{1-x}Mo_xO_2$ ($x = 0 - 0.04$) thin films on Al_2O_3 (0001) substrates by means of low-oxygen MAD technique. Resistivity and Raman measurements probe the position of the MIT and SPT for a better understanding of the correlation between both phase transitions.

This work is supported by the German Science Foundation through SFB 1073, TP B04.

[1] N. Shukla *et al.*, Nat. Commun. **6**, 7812 (2015)
[2] D. Wegkamp, Dissertation, FU Berlin (2015)
[3] E. Strelcov *et al.*, Nano Lett. **12**, 6198 (2012)

DS 12.54 Mon 17:00 Poster A

Phase Change Characteristics of Sn/Pb Chalcogenides — •Zheng Zeng[1], Stefan Jakobs[1], and Matthias Wuttig[1,2] — [1]I. Physikalisches Institut (IA), RWTH Aachen University, 52056 Aachen, Germany — [2]JARA - Fundamentals of Future Information Technology, RWTH Aachen University, Germany

Phase change materials (PCMs) uniquely combine physical properties. They exhibit a large electrical and optical contrast between their amorphous and crystalline phases. Moreover, the switching between these two phases occurs on a nanosecond timescale rendering those materials perfect candidates for data storage applications.[1]

So far, mainly compositions consisting of Ge, such as $Ge_1Sb_4Te_7$, $Ge_1Sb_2Te_4$ and $Ge_2Sb_2Te_5$, have been identified as PCMs, and some of them are frequently applied in commercial products like rewritable DVD. In this work, we focus on Sn and Pb chalcogenides, which are isoelectronic substitutions of Ge, and explore their potential as possible phase change materials.

Our samples are made as thin films via sputter deposition and are subsequently characterized by means of X-ray diffraction, Van-der-Pauw measurements and Fourier transform infrared spectroscopy.

[1] Wuttig, M. and Yamanda, N. Nature materials 6(11), 824-832 (2007)

DS 12.55 Mon 17:00 Poster A

Ellipsometric characterization of doped SnO_x layers for novel SPR-based gas sensors — •Daniel Fischer[1], Andreas Hertwig[1], Uwe Beck[1], Martin Kormunda[2], and Norbert Esser[3] — [1]BAM Federal Institute for Materials Research and Testing, Division 6.7 — [2]J.E. Purkyne University, Faculty of Science, Department of Physics — [3]Leibniz-Institut für Analytische Wissenschaften ISAS e.V.

In the present research a surface based gas detection technique is investigated using the SPR effect with ellipsometric readout. The sensor consists of a gold layer (∼40 nm) top-coated with a doped metal-oxide (M:SnO_x,∼5 nm). The coating was added by magnetron sputtering with doped targets and different doping concentration. In the past, it could be shown that these type of sensors can detect various gases, e.g. CO, H_2, O_2, O_3, He, N_2 with sensitivities down to the ppm range. The goal of the present study is to characterize the doped metal-oxide top-coating material in dependence of the coating conditions. Changing the properties of the plasma coating process and the doping gives access to a variety of different layer properties and enables us to find the best conditions for the determined gas in selectivity and sensitivity. The resulting layers are analyzed mainly by using spectroscopic ellipsometry to extract the optical constants n and k to find a correlation between the doping properties and the sensing ability for specific gas species. Further methods like TEM, XRD and TOF-SIMS are used to identify the structure of the surface and to extract the doping concentration of the coating.