DS 19 Thin film deposition and process characterization I

Time: Thursday 11:30–12:45 Room: GER 38

DS 19.1 Thu 11:30 GER 38

In-situ **mechanical spectroscopy on pulsed laser deposited polymer films** — •Thorsten Scharf, Erik Süske, and Hans-Ulrich Krebs — Institut für Materialphysik, Universität Göttingen, Friedrich-Hund-Platz 1, D-37077 Göttingen

Pulsed laser deposition (PLD) is a promising technique for the preparation of thin films, including non-equilibrium composites of polymers with metals or ceramics. Laser deposited polymers are chemically modified due to the depositon process and therefore show different mechanical properties. To determine these properties in dependency of the deposition parameters and to learn about the microscopic processes leading to these properties an *in-situ* mechanical spectroscopy apperatus was developed, where the excitation of an vibrating reed is done by the plasma plume of the PLD. This new technique will be shown in detail with results for the temperature dependent spectroscopy on PMMA which was laser deposited under different deposition parameters.

DS 19.2 Thu 11:45 GER 38

Ba substituted $Pb(Zr_xTi_{1-x})O_3$ Thin Films grown by MOCVD — •Jochen Puchalla, Susanne Hoffmann-Eifert, and Rainer Waser — IFF/IEM and CNI, FZ Jülich, Jülich, Germany

The most prominent ferroelectric material for integrated non-volatile memories is $Pb(Zr,Ti)O_3$. In this study we report on the modification of PZT thin films by substitution of Pb against Ba in order to study the effects accompanied with incorporation of a bigger A-site cation in the PZT system. The polycrystalline $(Pb,Ba)(Ti,Zr)O_3$ films are grown on $Ir(111)/TiO_2/SiO_2/Si$ as well as on $Pt(111)/TiO_2/SiO_2/Si$ substrates at temperatures between 580°C and 650°C applying a liquid-delivery MOCVD technique. A PZT (30/70) film of 150 nm thickness shows good ferroelectric properties with $P_r = 35\ \mu C/cm^2$ and $E_c = 90$ kV/cm. In first randomly oriented films the Ba substitution was unfortunately not effective in lowering the coercive field. The $(Pb,Ba)(Ti,Zr)O_3$ films show improved phase stability and a more homogeneous morphology compared to the pure PZT films. In addition the dielectric losses in the PBZT films are as small as 0.025. The presentation will in addition deal with the Ba substitution effect in films with a preferred orientation of the grains, namely (111). Further studies address the formation of IrO_2 or $PbPt_x$ interfacial layers, and the analysis of the ferroelectric and dielectric properties and the leakage currents in the Ba-doped PZT thin films.

DS 19.3 Thu 12:00 GER 38

In situ doping profiling of MOVPE-grown GaAs — •Ch. Kaspari[1], M. Pristovsek[1], and W. Richter[2] — [1]Technische Universität Berlin, Institut für Festkörperphysik, Sekr. PN 6-1, Hardenbergstraße 36, D-10623 Berlin — [2]Università di Roma "Tor Vergata", Dipartimento di Fisica, Via della Ricerca Scientifica 1, I-00133 Roma, Italy

It is well known that doping of III-V-semiconductors can be measured with reflectance anisotropy spectroscopy (RAS) [1]. The interface electric field induced by the dopant atoms changes the RAS spectrum. This change, observed near the E_1 and higher critical points, can be described by the linear electro-optic effect (LEO).

We have found that during growth of GaAs layers with different doping concentrations, oscillations appear in the RAS signal at photon energies near the fundamental band gap E_0. From the period of these oscillations the thickness can be obtained during growth. The amplitude of the oscillations is related to the doping contrast. With this information, a profile of the doping concentration can be measured *in situ*. To refine the accuracy of our measurements, we employ a multichannel RAS setup [2] that is designed to measure transients at multiple photon energies simultaneously in the spectral range between 1.5 and 5 eV.

[1] Tanaka et al., Appl. Phys. Lett. **59**, 3443 (1991)
[2] Kaspari et al., phys. stat. sol. (b) **242**, 2561 (2005)

DS 19.4 Thu 12:15 GER 38

Role of positive ions in reactive sputtering of Al-doped ZnO thin films — •F. Ruske[1], V. Sittinger[1], W. Werner[1], B. Szyszka[1], R. Wiese[2], M. Hannemann[2], and H. Kersten[2] — [1]Fraunhofer IST, Bienroder Weg 54 E, D-38108 Braunschweig — [2]INP Greifswald, F.-L.-Jahn-Str. 19, D-17489 Greifswald

Highly conductive, transparent films (ITO, SnO_2, ZnO) are of significant interest i.e. in the field of thin film photovoltaics, flat panel display or automotive glazings. Especially ZnO-based films have attracted much interest due to low material cost at accaptable film properties in respect to ITO. Reactive magnetron sputtering of metallic Zn/Al-targets has shown to be a suitable way to produce high quality Al-doped ZnO thin films.

In order to characterize the deposition process films have been deposited onto stationary substrates and characterized in respect to chemical composition, texture, etching behaviour as well as optical and electrical properties. In these measurements significant differences in respect to films deposited onto moving substrates can be found.

The key to understanding properties distributions are particle and energy fluxes onto the substrate. We present measurements with a retarding field analyzer (RFA) yielding energy-resolved distributions of positive ions. The measurements show that no highly energetic ions with positive charge are obtained with the present setup and most ions originate from the Debye sheath. Measurements of total energy flow show that energy introduction by positive ions plays only a minor role in the examined process.

DS 19.5 Thu 12:30 GER 38

Thin film combined systems for detection of ionizing radiation — •Sergiy Nedilko[1], Volodymyr Degoda[1], Borys Okhrimenko[1], Igor Zakharchenko[1], Yuriy Zorenko[2], and Georgiy Malashkevich[3] — [1]Kyiv National Taras Shevchenko University, 2, block 1, acad. Hlushkov Ave., 03680, Kyiv, Ukraine — [2]Ivan Franko National University of Lviv, 8, Kyryla & Mefodiya Str., Lviv, Ukraine — [3]Institute of Molecular and Atomic Physics of BAS, 68, F. Skarini Ave., Minsk, Belarus

Two oxide systems doped with cerium ions are developed for registration of partial components of mixed ionizing flows. The first are detectors based on the grown by liquid phase epitaxy YAG and LuAG films co-doped with Ce and Sc, Tb and Eu ions. Mentioned oxides and their structural types have to allow a possibility of wide modification of both the single-crystalline films and substrates compositions for optimization of detectors parameters. Some oxide sol-gel thin films co-doped with Ce and Ag are the seconds systems. In this case increasing intensity of Ce luminescence resulted by interaction between Ce ions and silver nanoparticles. We assume the data are explained by the overlapping of the Ce ions spectral bands with absorption bands of surface plasmons in silver nanoparticles. The luminescence intensity depends on the preparation procedure, redox conditions of heat-treatment as well as on the dopants concentrations. Experiments with of synchrotron radiation use were done at SUPERLUMI, HASYLAB, Germany. This work is supported by STCU Project No 2042.