DS 22 Thin film deposition and process characterization II

Time: Thursday 14:00–15:15 Room: GER 38

DS 22.1 Thu 14:00 GER 38

Functionalising of Tips for Scanning Probe Microscopy — •Danny Kowerko, Falk Müller, Andi Käppel, Steffen Schulze, and Michael Hietschold — TU Chemnitz, Institut für Physik

Throughout the last 15 years different material deposition techniques have become powerful tools for creating nanodots, nanowires, nanotips and nanolayers. In this work the application potential of EBID-(Electron Beam Induced Deposition)-nanotips as probes for SPM (scanning probe microscopes) will be discussed. A precursor material is sublimated and aligned by dint of a needle close to a silicon substrate or an AFM-Cantilever. A fine focused electron beam dissociates the adsorbed molecules and a tip will be generated. The influence of secondary electron-distribution, surface diffusion and dissociation energies of the precursor materials like tungstenhexacarbonyl ($W(CO)_6$) hint at the chances and limits of forming SPM tips on different surface geometries such as AFM-Cantilevers. As a possibility to overcome the current density limitation at usual SEMs, field emission induced deposition (FEID) is mentioned for fabrication of sub-10-nm-deposits consisting of highly conducting or magnetic material. Therefore FEID-whisker growth at the apex of STM-tips can be exhibited.

DS 22.2 Thu 14:15 GER 38

Thin Zn-Phthalocyanine films in ITO sputter processes — •Martina Mohr, Klaus Ellmer, and Konstantinos Fostiropoulos — Hahn-Meitner-Institut Berlin, Glienicker Str. 100, D-14109 Berlin

Indium-tin-oxide (ITO) films are widely used as conductive transparent electrodes for optoelectronic devices. However for stability reasons they are usually not sputter grown directly on photoactive organic materials. Here we present a bi-layer system consisting of sputter deposited ITO on vacuum evaporated Zn-Phthalocyanine films. The influence of the sputter process on the organic material and the quality of the ITO layer has been studied by means of optical spectroscopy, XRD and SEM. New ITO structures and morphologies have been discovered. The absorption spectra of the Zn-Phthalocyanine film as well as the conductivity of ITO in these bi-layers are promising for photovoltaic applications.

DS 22.3 Thu 14:30 GER 38

At wavelength inspection of extreme ultraviolet lithography mask blank defects by photoemission electron microscopy — •Jingquan Lin[1], Andreas Oelsner[2], Nils Weber[3], Ulrich Neuhäusler[1], Jawad Slieh[1], Armin Brechling[1], Dimitrii Valdaitsev[2], Michael Merkel[3], Gerhard Schönhense[2], Ulf Kleineberg[1], and Ulrich Heinzmann[1] — [1]Faculty of Physics, University Bielefeld, D-33615 Bielefeld — [2]Institute of Physics, University of Mainz, D-55128 Mianz — [3]Focus GmbH, D-65510 Hünstwetten-Gorsröth

Extreme ultraviolet lithography (EUVL) is one the leading next-generation lithography candidates for fabricating integrated circuits with a feature size of 45 nm and below. According to International Semiconductor Road map, density of defects on EUV mask blank must be reduced to the level of 0.005 defects per cm^2. Here we report a new actinic EUVL mask defect inspection approach, in which EUV photoemission electron microscopy (PEEM) technique was used. The actinic inspection experiment was performed with a standing wave field illumination PEEM at BESSY II. Experimental results show that buried defects with lateral sizes down to 50 nm in a mask blank sample are detectable. Our EUV PEEM also demonstrates the ability to detect phase defects with height as low as 6 nm in a programmed line-space sample. Moreover, we found that the contrast of a multilayer phase defect in the PEEM image is strongly dependent on the inspecting wavelength, eg. showing a contrast reversal when changing the illumination wavelength from 12.5 nm to 13.8 nm.

DS 22.4 Thu 14:45 GER 38

Hydrogen assisted growth of Fe/V superlattices — •Gregor Nowak[1], Arndt Remhof[1], Andreas Liebig[2], Björgvin Hjörvarsson[2], and Hartmut Zabel[1] — [1]Fakultät für Physik und Astronomie, Festkörperphysik, Ruhr-Universität Bochum — [2]Department of Physics, University of Uppsala, Sweden

We have studied the influence of hydrogen on the growth of sputter deposited Fe/V superlattices. We show that the high structral quality achieved previously [1] can be further improved by using a hydrogen enriched process gas. The multilayers have been grown epitaxially on MgO(001) substrates at elevated temperatures by DC-magnetron sputtering. In an argon-atmosphere (p_{Ar} = 7 mbar) containing a hydrogen partial pressures of up to 2×10^{-6}mbar we deposited [Fe(2ML)/V(16ML)]×30 superlattices. At each chosen hydrogen pressure we prepared a series of samples at substrate temperatures between 270°C and 320°C. The structural characterization was carried out by x-ray diffraction at the wiggler beamline W1.1 of the Hamburg synchrotron laboratory (HASYLAB). Two trends are clearly observed. The mosaicity decreases with increasing H-pressure. Simultaneously, the interface quality increases, shown by x-ray reflectivities studies. We attribute this effects to an increased surface mobility of the metal atoms in the presence of hydrogen [2].This project was founded by the DFG under contract-Nr. RE 2203/1-1.

[1]P. Isberg et al., Vacuum 48, 483 (1997).
[2]Horch et al., Nature 398, 132 (1999).

DS 22.5 Thu 15:00 GER 38

Influence of salt ions on the structure of polyelectrolyte multilayers — •Christof Ecker[1], John E. Wong[2], Pantea Nazaran[3], and Regine v. Klitzing[1] — [1]Christian-Albrechts-Universität Kiel, Institut für Physikalische Chemie, Ludewig-Meyn-Str. 8, 24118 Kiel — [2]RWTH Aachen, Institut für Physikalische Chemie, Landoltweg 2, 52056 Aachen — [3]Max-Planck-Institut für Kolloid- und Grenzflächenforschung, Wissenschaftspark Golm, 14424 Potsdam

A polyelectrolyte multilayer is grown by dipping the substrate alternately into solutions of polycations and polyanions. At each step a polyelectrolyte layer adsorbs from solution onto the surface.

We investigated how the addition of monovalent salt to the solutions of polyanions (PSS) and polycations (PAH or PDADMAC) influences the structure of such layers. We found that the layer thickness always increases with salt concentration. We explain this by the more compact conformation in solution. Further, we found a strong dependence on the type of salt. Films built-up with NaBr are about five times thicker compared to those prepared with NaF. The mobility of the polymers chains within the multilayer film was measured using FRAP (Fluorescence Recovery After Photo bleaching). We found the mobility for films prepared under NaBr conditions to be large compared to films prepared with NaCl and similar to films prepared from a less charged copolymer. This indicates that Br- ions are embedded within the film reducing the charge of the polycations extrinsically and whereas Cl- ions are not. We further performed calorimetric experiments to quantify the interaction between polyelectrolyte and salt ions.