DS 31: Application of Thin Films

Time: Thursday 11:15–12:30 Location: H 2032

DS 31.1 Thu 11:15 H 2032

Piezoelectric thin film devices for biochip applications — •Kerstin Wätje[1,2], Jens Ebbecke[1,2,3], and Achim Wixforth[1,2] — [1]Universität Augsburg, Lehrstuhl für Experimentalphysik I, 86159 Augsburg — [2]Center of Nano Science, Geschwister-Scholl-Platz 1, 80539 München — [3]School of Engineering and Physical Science, Heriot-Watt University, Edinburgh, EH14 4AS, United Kingdom

"Lab-on-a-chip-devices" are well suited for the analysis of least amounts of liquids. Therefore, such systems are emerging from prototype status and cost effective materials for mass production are sought. For handling and mixing components, surface acoustic waves generated by piezoelectric elements are meanwhile routinely employed; however, the LiNbO3 single crystals usually used in such units are a significant cost factor. As an alternative, zinc oxide layers deposited onto glass substrates hold the promise of cheaper production and easier integration into the assembly. In the present study, experiments regarding the deposition of such layers using different plasma processes are presented. Film synthesis was performed using rf magnetron sputtering, pulsed laser deposition and plasma based ion bombardment of Sol-Gel films on crystalline and amorphous substrates. The impacts of significant deposition parameters are discussed. At optimum deposition parameters, excellent columnar growth in the preferred c-axis orientation could be observed. The suitability of such films for the desired biochip application is substanciated through first mixing experiments using optically lithographed interdigital transducers (IDTs).

DS 31.2 Thu 11:30 H 2032

Combinatorial development of ternary and quaternary shape memory thin film systems — •Robert Zarnetta[1,2], Sigurd Thienhaus[1,2], Alan Savan[2], and Alfred Ludwig[1,2] — [1]Institut für Werkstoffe, Ruhr-Universität Bochum, Germany — [2]Forschungszentrum caesar, Bonn, Germany

Current development goals for shape memory alloys in the area of conventional alloys are to decrease the transformational hysteresis to values below 5 K as well as to increase transformation temperatures to values above 100°C. In order to reach theses goals, thin film combinatorial and high-throughput technologies were applied. Ternary and quaternary materials libraries (continuous composition spreads) were deposited by optimized magnetron sputter techniques. The high-throughput characterization was performed by automated EDX (composition), XRD (microstructure), as well as temperature-dependent resistivity measurements revealing the phase transformation properties of the thin films. Temperature-dependent stress measurements on micro-structured cantilever Si-wafers with integrated 4-point resistivity measurement on each cantilever in a temperature range from -100°C up to 600°C were applied to characterize the actuator behavior. Results are presented for ternary Ni-Ti-X (X = Cu, Pd, Hf, Ag, ...) and quaternary Ni-Ti-Cu-Pd systems. Next to extending the knowledge about transforming compositions in ternary systems, special compositions or compositional regions with optimized properties were found.

DS 31.3 Thu 11:45 H 2032

Design, Characterization and Applications of Broadband MoSi- Multilayer Mirrors for Attosecond XUV Pulses — •Michael Hofstetter[1], Andy Aquila[3], Eleftherios Gouliemakis[2], Martin Schultze[2], Matthias Uiberacker[1], Eric Gullikson[3], David Attwood[3], Ference Krausz[2], and Ulf Kleineberg[1] — [1]LMU Munich — [2]MPI for Quantum Optics — [3]CXRO Berkeley Lab

Multilayer(ML)-coated XUV mirrors in combination with ultrathin metal transmission filters are known to be very suitable for spectral filtering and guiding of single attosecond (asec) XUV pulses from the near-cutoff region of High Harmonic Generation (HHG) sources in rare gases. We report on the design of periodic and aperiodic, broadband (15 - 30 eV) Mo/Si ML centered at ≈ 85 eV, theoretically developed by a needle algorithm code (optilayer) for optimum pulse response. Recent results published have demonstrated the filtering of single 170 asec pulses, recorded in XUV pump/IR probe streaking experiments, using an additional 150 nm Zr filter.[1] Even shorter pulse durations towards the (sub) 100 asec range are expected. The ML stacks have been fabricated by advanced Dual Ion Beam Deposition (DIBD) controlled by in-situ ellipsometry and ex-situ characterized by synchrotron radiation measurements at the Advanced Light Source. Finally, the extension of asec ML mirror technology towards higher photon energies exceeding 100 eV using different materials (La and B_4C) will be discussed, which could enable new photoemission experiments on solid surfaces with sub 100 asec time resolution.

[1]New Journal of Physics 9 (2007) 243

DS 31.4 Thu 12:00 H 2032

The influence of dc sputtered ZnO:Al/a-Si:H/c-Si heterostructures — •René Köhler[1,2], Andreas Schöpke[2], Sviatoslav Shokhovets[1], Gerhard Gobsch[1], and Manfred Schmidt[2] — [1]Technische Universität Ilmenau, EXP I, Weimarer Straße 32, D-98693 Ilmenau, Germany — [2]Hahn-Meitner-Institut Berlin, Kekuléstraße 5, D-12489 Berlin, Germany

Transparent conductive oxides (TCO's) are an essential part of optoelectronic and photovoltaic devices. In ZnO:Al/a-Si/c-Si heterostructure solar cells, one cruicial point for the performance of the device are interface states at the a-Si/c-Si interface which may influence the band bending in c-Si at this interface. The aim of this work was to find out whether the ZnO:Al deposition by reactive dc magnetron sputtering does affect the properties of the a-Si:H/c-Si interface. For this purpose, the large signal photovoltage method (SPV; laser pulse excitation 910 nm, 162 ns pulse length) was used to measure the band bending in c-Si before and after ZnO:Al deposition and after removing the ZnO:Al film by etching in HCl. So, from the variation in the SPV signal we can draw conclusions about the influence of the sputter deposition process on the properties of the a-Si/c-Si interface.

DS 31.5 Thu 12:15 H 2032

Application aspect of the silicon light emitters — •Charaf Cherkouk, Lars Rebohle, Slawek Prucnal, Wolfgang Skorupa, and Manfred Helm — Institute of Ion Beam Physics and Materials Research,Forschungszentrum Dresden-Rossendorf (FZD), POB 51 01 19 Dresden Germany

The immediate and accurate monitoring of chemical and biological substances is the key issue in environmental analysis for minimizing the health risk for citizens and their exposure to pollutants. Recently, considerable attention has been focused on endocrine-disrupting compounds EDCs, such as estrogens, which constitute a wide group of environmental pollutants, especially in drinking water. A new concept for measuring the concentration of such organic compounds by using Si-based integrated light sources for fluorescence analysis is presented. In that concept the analyte, estrogen in this example, is labelled with a Fluorescence marker with a large Stokes shift and is immobilized at the passivated surface of the light emitter by receptor molecules. This simple labelling opens a way to extremely small device dimensions and is of great interest for point-of-care measurements. The current system has been characterized by FTIR, Raman and electroluminescence measurements.