DS 25: Application of Thin Films

Time: Wednesday 16:00–17:00 Location: H8

DS 25.1 Wed 16:00 H8

Development of Multilayer Laue Lenses for soft X-ray radiation — •Tobias Liese[1], Hans-Ulrich Krebs[1], Michael Reese[2], Peter Grossmann[2], and Klaus Mann[2] — [1]Institut für Materialphysik, Universität Göttingen, Friedrich-Hund-Platz 1, 37077 Göttingen — [2]Laser-Laboratorium Göttingen e.V., Hans-Adolf-Krebs-Weg 1, 37077 Göttingen

Despite the improvements of fabrication techniques for Fresnel Zone Plates as diffractive optics for X-ray microscopy, the spatial resolution with high diffraction efficiencies has reached a limit mostly. A novel approach to focusing soft X-rays in the water window regime (2.3 − 4.4 nm) is to prepare non-periodic multilayer structures using as 1-dimensional zone plates in Laue diffraction geometry. For this purpose ZrO_2/Ti multilayers were deposited by pulsed laser deposition (PLD) on Si(111) substrates in ultrahigh vacuum. The interfaces within the multilayer are positioned according to the Fresnel zone plate law. In this contribution, results of the Laue Lens fabrication by focused ion beam (FIB) and lens characteristics measured by a table-top X-ray source are presented.

DS 25.2 Wed 16:15 H8

AlN-basierte Mikrogeneratoren — •Oliver Bludau, Claus-Christian Röhlig, Lutz Kirste, Ram Ekwal Sah, Rachid Driad, Vadim Lebedev, Volker Cimalla, Christoph Nebel und Oliver Ambacher — Fraunhofer Institut für Angewandte Festkörperphysik IAF, Freiburg

Auf Basis mikromechanischer Resonatorstrukturen (Cantilever) wurden Mikrogeneratoren entwickelt, mit denen im menschlichen Körper vorhandene mechanische Energie (Vibrationen) in elektrische Energie umgesetzt werden kann. Diese Mikrogeneratoren sollen in der Lage sein, implantierte Sensorsysteme mit Energie zu versorgen. Für die Energiewandlung wurden piezoaktive (c-Achsen orientierte) Aluminiumnitrid (AlN)-Dünnschichten (d = 200 nm) in einem RF-Magnetron Sputterprozess abgeschieden und mittels Röntgen-Diffraktometrie charakterisiert. Der piezoelektrische Modul (d_{33}) der Schichten wurde mit Piezoelektrischer Kraftmikroskopie und Laser-Doppler Vibrometrie gemessen. Die Cantilever wurden extern angeregt und die durch die Dehnung der AlN-Schicht generierte Piezospannung mit einem Oszilloskop gemessen. Zudem erfolgte eine Untersuchung der Resonanzfrequenzen und der Gütefaktoren der Strukturen. Aufgrund der hohen piezoelektrischen Konstanten (e_{33} = 1,5 C/m^2), der chemischen Stabilität in wässrigen Lösungen sowie der vorhandenen Biokompatibilität, ist eine Wandlung der im menschlichen Körper vorhandenen mechanischen Energie in elektrische Energie zum Betrieb implantierter Sensoren mit einigen Mikrowatt möglich.

DS 25.3 Wed 16:30 H8

Aluminum Nitride and Nanodiamond Thin Film Microstructures — •Fabian Knöbber, Oliver Bludau, Claus-Christian Röhlig, Oliver Williams, Ram Ekwal Sah, Lutz Kirste, Volker Cimalla, Vadim Lebedev, Christoph Nebel, and Oliver Ambacher — Fraunhofer-Institute for Applied Solid State Physics, Freiburg, Germany

In this work, aluminum nitride (AlN) and nanocrystalline diamond (NCD) thin film microstructures have been developed. Freestanding NCD membranes were coated with a piezoelectrical AlN layer in order to build tunable micro-lens arrays. For the evaluation of the single material quality, AlN and NCD thin films on silicon substrates were fabricated using RF magnetron sputtering and microwave chemical vapor deposition techniques, respectively. The crystal quality of AlN was investigated by X-ray diffraction. The piezoelectric constant d_{33} was determined by scanning laser vibrometry. The NCD thin films were optimized with respect to surface roughness, mechanical stability, intrinsic stress and transparency. To determine the mechanical properties of the materials, both, micromechanical resonator and membrane structures were fabricated and measured by magnetomotive resonant frequency spectroscopy and bulging experiments, respectively. Finally, the behavior of AlN/NCD heterostructures was modeled using the finite element method and the first structures were characterized by piezoelectrical measurements.

DS 25.4 Wed 16:45 H8

Single Ion Lithography — •Hans-Gregor Gehrke[1], Anne-Katrin Nix[1], Johann Krauser[2], Christina Trautmann[3], Alois Weidinger[4], and Hans Hofsäss[1] — [1]II. Physikalisches Institut, Universität Göttingen, Germany — [2]Hochschule Harz, Wernigerode, Germany — [3]Gesellschaft für Schwerionenforschung, Darmstadt, Germany — [4]Hahn-Meitner-Institut, Berlin, Germany

Swift Heavy ion irradiation of polycarbonate creates latent tracks along each ion track. Chemical wet etching allows selective removal of the path creating small pores through the polymer film. In the past we developed a method to create thin polycarbonate films by spin coating allowing the etching of pores with diameters in the range of 50 - 80 nm. These nano-pores serve as templates to create nanostructures. Besides depositing materials through the pores, it is possible to sputter cavities into the substrate. This technique has some possible applications, as for example, the creation of structured substrates for nano-wires requiring small catalyst clusters (e.g. gold). The combination of creating cavities by sputtering and depositing the catalyst into cavities results in embedded catalyst clusters providing advantages for epitaxial growth. In addition, this procedure is a parallel process allowing to structure large areas with millions of devices simultaneously. Another application is the creation of electrode structures. We demonstrate the principle of creating a field emission structure using the described structuring method and the self-alignment of conducting nano-wires in diamond-like carbon created by the same ion during irradiation.