DS 16: Atomic Layer Deposition

Time: Tuesday 12:15–13:00 Location: H 0111

DS 16.1 Tue 12:15 H 0111

SiO_2-, Al_2O_3-, and TiO_2-nanotubes synthesized by ALD in etched ion-track membranes — •Anne Spende[1,2], Nicolas Sobel[2], Christian Hess[2], Manuela Lukas[2], Bernd Stühn[2], Josep M Montero Moreno[3], Robert Zierold[3], Kornelius Nielsch[3], Christina Trautmann[1,2], and Maria Eugenia Toimil-Molares[1] — [1]Materialforschung, GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt — [2]Technische Universität Darmstadt — [3]Universität Hamburg

Nanochannels and nanotubes of tailored dimensions and surface coatings are of great interest for basic research and applications e.g. in nanofluidics or sensoric. By combining ion-track nanotechnology with atomic layer deposition (ALD), we present a novel approach to fabricate inorganic nanotubes and surface modified nanochannels with aspect ratios above 3000. 30 μm thick polycarbonate foils are irradiated with GeV Au ions at the UNILAC accelerator of GSI. Subsequent chemical etching converts the ion tracks into open, cylindrical channels, with smallest achievable diameter presently down to 18 nm. We further reduced channel diameters of etched ion-track membranes in a controlled manner by applying ALD to coat the surface with SiO_2, Al_2O_3, and TiO_2. By dissolving the polymer template, nanotubes with well defined wall thickness were obtained. ALD-coated membranes and released nanotubes were analysed by small-angle x-ray spectroscopy, electron microscopy and EDX. The coating is shape conformal and highly homogeneous along the entire channel length. XPS shows the stoichiometric composition of the deposited films.

DS 16.2 Tue 12:30 H 0111

Atomic Layer Deposition and characterization of Ga-doped Sb_2Te_3 thin films at low temperatures. — •Christoph Wiegand[1], Monika Rusek[2], Johannes Gooth[1], Robert Zierold[1], Stephan Schulz[2], and Kornelius Nielsch[1] — [1]Institut für Nanostruktur- und Festkörperphysik, Universität Hamburg — [2]Institut für Anorganische Chemie, Universität Duisburg-Essen

Semiconductors of the V_2VI_3-type have recently become in the focus of a new type of material class, called topological insulators (TIs). TIs are bulk insulators that offer time-reversal symmetry protected highly conductive surface states.

We demonstrate the growth of antimony telluride and gallium telluride thin films via ALD at temperatures below 100 °C, which is relatively low compared to CVD or comparable techniques. In supercycle approach depicted $Ga_xSb_{2-x}Te_3$ compounds and nanolaminates have been synthesized and have led to an understanding of the crystallization behavior of Sb_2Te_3 in dependence of the Ga-content and the underlying substrate. We were able to determine the minimum Ga-content needed for single-crystalline growth of $Ga_xSb_{2-x}Te_3$ thin films. Moreover, actual studies are performed on the measurement of the electrical transport properties of these $Ga_xSb_{2-x}Te_3$ films using a micron-sized hall-bar device fabricated by standard photolithography and lift-off processing.

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DS 16.3 Tue 12:45 H 0111

Encapsulation of Silver Nanowires in Transparent Conductive Oxides by Atomic Layer Deposition — •Manuela Göbelt[1], Ralf Keding[1], Björn Hoffmann[1], Sebastian Schmitt[1], Sara Jäckle[1], Michael Latzel[2], and Silke Christiansen[1,3] — [1]Max Planck Institute for the Science of Light, Günther-Scharowsky-Str. 1/Bau 24, Erlangen, Germany — [2]Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Institute of Optics, Information and Photonics, Staudtstr. 7/B2, Erlangen, Germany — [3]3Helmholtz Center Berlin for Energy and Materials, Hahn-Meitner-Platz 1, Berlin, Germany

Aluminum doped ZnO (AZO) has become a promising material for transparent electrodes due to its high abundance and its suitable electrical and optical properties. However, the sheet resistance of AZO is rather high to adapt as transparent electrode. Silver nanowire (AgNW) networks encapsulated in an AZO layer hold the promise to significantly decrease its resistivity, but the encapsulation of high aspect ratio structures is rather difficult to achieve by conventional deposition techniques. Atomic layer deposition (ALD) is a useful technique to deposit homogenous and uniform layers e.g. on nanostructures used in third generation solar cell concepts. This deposition technique is based on a self-limiting reaction mechanism, which guarantees excellent film deposition conformity and atomic-scale thickness control. The encapsulation of AgNWs by ALD is shown and optimization routes for its conductivity and transparency are pointed out. Furthermore, the application of AgNW/AZO-TCOs for silicon solar cells is discussed.