DS 3: Layer Deposition Processes

Time: Monday 15:45–17:15 Location: GER 37

DS 3.1 Mon 15:45 GER 37

Growth of carbon nanotubes on different support/catalyst systems for interconnect and sensor applications — •Sascha Hermann[1], Ramona Ecke[1], Barbara Pahl[2], and Stefan E. Schulz[1,3] — [1]Chemnitz University of Technology, Center for Microtechnologies, 09126 Chemnitz, Germany — [2]Fraunhofer Institute for Reliability and Microintegration, 13355 Berlin, Germany — [3]Fraunhofer ENAS for Electronic Nanosystems, 09126 Chemnitz, Germany

This work is focused on the growth of aligned densely packed multi walled carbon nanotubes (MWNT) for the application as Via-interconnects. We have conducted a parametric study on different support/catalyst systems and investigated its influence on CNT growth performed with thermal CVD. Basic studies with the support/catalyst combination SiO_2/ Ni were conducted to study the influence of gas composition, temperature and catalyst thickness. Furthermore, we have prepared bi-catalytic systems like NiMo and CoMo and investigated its influence on catalyst effectiveness and CNT growth temperature. As a step towards integration, we have prepared patterned substrates with a complete metallization system including a Cu/TiN/Ni layer stack. We have achieved selective growth of densely packed vertical aligned MWNTs. Electrical measurements of flip-chip connections indicate good electrical properties of the CNT-arrays.

DS 3.2 Mon 16:00 GER 37

Vapor–liquid–solid growth of silicon on glass — •Robert Heimburger[1], Nils Dessmann[1], Thomas Teubner[1], Rainald Mientus[2], and Torsten Boeck[1] — [1]Leibniz–Institut für Kristallzüchtung, Max–Born–Straße 2, D–12489 Berlin, Germany — [2]OUT e.V., Köpenicker Straße 325, D–12555 Berlin, Germany

Development of low cost deposition techniques leading to high quality polycrystalline silicon films on glass is of great interest for solar cell industry. By taking advantage of growth from metallic solutions, vapor–liquid–solid processing promises both, cheap processing and good crystalline quality. In a first step, a liquid metallic solvent (indium) is deposited on glass, which was previously coated with thin conductive layers, to form well distributed microdroplets on the surface. These droplets act as nucleation sites for silicon deposited in a second step. Outgrowth of separated silicon seed crystals is done using specially adopted steady–state liquid phase epitaxy equipment [1].

One key factor for process development is the proper selection of backside contact material regarding thermodynamic stability, adhesion and wettability. Thermodynamic stability, i.e. the ability to withstand the silicon saturated solution during outgrowth, depends crucially on heat treatment during deposition process. Wettability is shown to be a function of deposition temperature, rate and surface pretreatment. Fully processed samples exhibit significant outgrowth of seeds into typically {111} faceted silicon crystals demonstrating the feasibility of the process.

[1] T. Teubner et al., Cryst. Growth Des. 2008 8 (7), 2484–2488

DS 3.3 Mon 16:15 GER 37

Epitaxial Growth of Ni on Si(100) Substrate by DC Magnetron Sputtering — •Wolfgang Kreuzpaintner, Michael Störmer, Dieter Lott, Danica Solina, and Andreas Schreyer — GKSS Forschungszentrum GmbH, Max-Planck-Str. 1, 21502 Geesthacht

The influence of the substrate temperature on the growth of highly textured Ni(111) and epitaxial Ni(200) with the epitaxial relationship Ni[100]||Si[110] and Ni(001)||Si(001) on hydrogen terminated Si(100) wafer substrates by means of direct current magnetron sputtering will be reported. To minimize crystal defect formation and in order to achieve a high quality epitaxial growth of Ni on Si a two step deposition process was developed whereby different deposition conditions were used for an initial nickel seed layer and the remaining nickel film. In-plane and out-of-plane structural properties of the deposited films were investigated using x-ray scattering techniques whereas magneto-optical Kerr effect and neutron reflectometry were used to confirm their magnetic nature.

DS 3.4 Mon 16:30 GER 37

Sputtering of TiO_2 under PEM-control — •Dieter Mergel, Farhad Mohtascham, and Özgür Aktas — Universität Duisburg-Essen, FB Physik, 47048 Duisburg

16 layers of TiO(2) have been deposited by sputtering from a metallic target. Three process parameters have been varied:

* deposition temperature (ambient or 300°C),
* O(2)-admixture to Ar (3
* plasma excitation (DC or RF).

In every run, a glass and a silicon substrate were coated simultaneously. The process was controlled by a plasma-emission monitor of the Ti-line, whose sensitivity had been gauged by systematic experiments beforehand.

On every sample, the packing density and the intensity of the Raman anatase line was determined and related to the deposition conditions.

The reproducibility of the process was improved before this deposition series and was tested by depositing two layers on two glass substrates in the same run.

DS 3.5 Mon 16:45 GER 37

Process Conditions for Atomic Layer Deposition of HfO_2 from Alkylamides and Consequences for Reactor Design — •Thomas Zilbauer, Torsten Sulima, and Ignaz Eisele — Universität der Bundeswehr München, Institut für Physik, 85577 Neuiberg

Atomic Layer Deposition (ALD) has been established as a manufacturing process for ultra thin films with high precision of conformal thickness control due to its ability of self-terminating deposition steps. To take advantage of this process stability gain, special precursors are needed, which must be very reactive in order to allow for fast chemisorption on the substrate surface without any desorption within the deposition cycle time. This high precursor reactivity on the other hand puts stringent demands on the delivery system and the reactor to prevent preliminary precursor decomposition.

Starting from a theoretical insight into the basic of the self-terminating ALD-chemistry, we will demonstrate the challenges and limitations for reactor design on the example of HfO_2-ALD using a Hafnium Alkylamide as precursor and a commercially available reactor. Additionally, we will present suggestions on potential improvements and results from their successful implementation.

DS 3.6 Mon 17:00 GER 37

Preparation of thin biaxial strained functional oxides and multilayers — •Sascha Trommler, Thomas Freudenberg, Ruben Hühne, Bernhard Holzapfel, and Ludwig Schultz — IFW Dresden, P.O. Box 270116, D-01171 Dresden, Germany

Functional oxides with a perovskite structure as well as structurally related compounds have attracted great interest within the last years. It was shown, that novel electronic phases can be formed at interfaces of epitaxial grown oxides as well as that the biaxial strain induced by the lattice mismatch may significantly affect the physical properties in these materials. A major prerequisite to study these effects is the controlled growth of epitaxial heterostructures on an atomic level in order to achieve smooth interfaces with a low density of defects. Therefore, pulsed laser deposition was used in combination with real time RHEED investigations to prepare heterostructures on single terminated substrates using layer-by-layer growth. Results on the deposition of atomically flat $La_{2-x}Ba_xCuO_4$, $LaAlO_3$ and $La_{1-x}Sr_xCoO_3$ layers on different substrates will be presented and discussed together with their structural and physical properties. Furthermore, the preparation of complex multilayers will be exemplarily shown for the $LaCoO_3|SrTiO_3$ system.