DS 28: Silicon Thin Films and Interfaces

Time: Friday 11:30–12:45 Location: H32

DS 28.1 Fri 11:30 H32

Evaluation of Low-Temperature SiO_x as an Insulating Barrier — •Oliver Senftleben, Peter Iskra, Tanja Stimpel-Lindner, Ignaz Eisele, and Hermann Baumgärtner — Universität der Bundeswehr München, Institut für Physik, Werner-Heisenberg-Weg 39, 85577 Neubiberg

Lowering the thermal budget in silicon process technology is one essential demand for the future. Feasibility of abrupt doping profiles or the application of new materials like SiGe, C_{60} or organic materials highly depends on a low-temperature insulating layer.

Therefore we investigated silicon suboxides which were deposited in a UHV-chamber by sublimation of silicon in oxygen atmosphere. Electrical quality of the oxide layers is the essential figure of merit. The main parameters for optimization are substrate temperature, oxygen partial pressure, silicon sublimation rate and appropriate annealing conditions. Oxygen partial pressure has been varied between 10^{-5} to 10^{-2} mbar, sample temperatures between 400°C and 600°C and the influence of in-situ annealing in oxygen, hydrogen and UHV at different temperatures has been studied.

Special interest has been taken on double layer systems consisting of thermally grown silicondioxide layers between 2.3 nm and 10 nm and subsequent deposition of SiO_x layers between 10 nm and 50 nm in thickness. These samples were electrically characterized by IV- and CV/GV-measurements in a MIS-structure. Morphology of the layers was investigated by SEM and AFM and the thickness and stoichiometry by AES and ellipsometry.

DS 28.2 Fri 11:45 H32

Thermische CVD-Abscheidung von Si-C-Schichten — Oliver Dirsus, •Dieter Mergel und Volker Buck — AG Dünnschicht-Technologie, Fb Physik, Universität Duisburg-Essen, 45117 Essen

Es wurden Si-C- Schichten bei Temperaturen von 880 bis 1050°C auf Si- und Quarz-Substraten abgeschieden und mit Röntgenbeugung, RBS, EDX und REM untersucht. Außerdem wurden Wachstumsraten, Massendichte und Schichtspannung bestimmt.

Das Schichtwachstum ist thermisch aktiviert und auf Si-Substraten schneller als auf Quarz-Substraten. Die Schichten enthalten mehr C als Si. Oberhalb von 930°C entstehen SiC-Körner. Bei den Schichtspannungen lassen sich thermische und intrinsische Anteile unterscheiden.

DS 28.3 Fri 12:00 H32

Nanometer thick antireflection coating for infrared light — •Bruno Gompf, Jürgen Beister, Tobby Brandt, Jens Pflaum, and Martin Dressel — Physikalisches Institut, Universität Stuttgart, Pfaffenwaldring 57, D-70550 Stuttgart

The optical properties of ultrathin Au films on silicon have been studied in the infrared over a wide frequency range from 200 cm^{-1} to 10.000 cm^{-1}. Thick films show a Drude behavior, i.e. with increasing frequency the transmission gets better; for films below the percolation threshold (at about 5 nm) a negative slope for the frequency dependent transmission is observed. When the thickness is further reduced, between 1 and 3 nm an anomaly occurs: the relative transmission reaches maximum values above 100 % compared to the bare substrate, indicating an antireflection coating of nm thickness for light with 5 μm wavelength. This anomaly can be explained in the framework of effective medium theories.

DS 28.4 Fri 12:15 H32

Influence of fluorine contamination on semiconductor wafer probing — •Markus Reinl[1], Torsten Sulima[1], Ignaz Eisele[1], Oliver Nagler[2], and Florian Kaesen[2] — [1]Institut für Physik, Universität der Bundeswehr, Neubiberg — [2]Infineon Technologies AG, München

Probing over active area (POAA) is getting more and more important in modern semiconductor production. As a result there is a strong demand on measuring the contact forces and the electrical resistance directly and online to get a better understanding of the failure mechanism. Therefore a new probing tool was developed at our institute. With our tool we can measure all probing relevant parameters like normal and lateral force and the electrical resistance directly on wafer level. In semiconductor production aluminum is still used as material for the probing and bonding pads. It is widely spread that the difficulties during probing are caused by the native aluminum oxide on top of the aluminum pads. We will show measurements for the electrical resistance on aluminum and on gold pads and show that the native oxide is not the only reason for a bad electrical resistance. Also fluorine contaminations, caused by fluorine plasma used to open the passivation for the probing pads, must be considered. To examine the influence of fluorine contaminations of the probing pads we will show measurements of the contact forces and the electrical resistance on aluminum pads exposed to fluorine plasma.

DS 28.5 Fri 12:30 H32

Influence of in-situ phosphorus doping on crystal quality of MBE grown silicon — •Ulrich Abelein, Lothar Höllt, Torsten Sulima, and Ignaz Eisele — Universität der Bundeswehr München, Institut für Physik, Werner-Heisenberg-Weg 39, 85577 Neubiberg

Molecular beam epitaxy (MBE) is a method for the epitaxial growth of silicon, which is very suitable for research applications as it allows in-situ doping, variation of layer thickness from a few to several hundred nanometers and changes of process parameters like growth rate and temperature over a wide range to optimise properties of grown layers. But especially the realization of extremely high doped layers, especially n-type with thickness of more than 50 nm, is difficult due to segregation and diffusion.

We investigated the crystal quality of highly phosphorus doped (up to 10^{20} cm^{-3}) monocrystalline silicon layers with thickness of several 100 nm. Layers with various phosphorus concentrations were grown at temperatures between 200°C and 400°C to find a good trade off between crystal quality and achievable doping level. The analysis was done by secondary ion mass spectroscopy (SIMS) and scanning electron microscopy (SEM) after HF:$C_2H_4O_3$ etching. The result of this work was a process window for the growth of nearly defect free layers with homogenous phosphorus doping up to 10^{19} cm^{-3} and thickness above 300 nm.