HL 14: Preparation and characterization

Time: Tuesday 9:30–10:00 Location: BEY 154

HL 14.1 Tue 9:30 BEY 154

XPS and NEXAFS Studies of Nitrogen Incorporated into ZnO During Epitaxial Film Growth — •Patrick Hoffmann and Christian Pettenkofer — Helmholtzzentrum Berlin, Albert-Einstein-Strasse 15, 12489 Berlin, Germany

The wide band gap semiconductor ZnO (gap=3.4eV) is heavily n-doped by nature. In the last years it has been shown that ZnO can be p doped by incorporation of nitrogen. Investigations have shown that nitrogen can replace oxygen (N_O, p doping), but can also be incorporated as molecular N_2 ($[N_2]_O$, n doping), and can be bonded to oxygen.

In this work, the ZnO films are grown by metal-organic MBE (MOMBE) on sapphire substrate (r plane). Nitrogen is supplied by an ion source using pure nitrogen (N_2) and nitrous oxide (N_2O). Additionally, a mass filter between the ion source and the sample can be used to reduce the influence of the neutrals (e.g. N_2), and to select certain ions and ion fractions (e.g. $N_2{}^+$, N^+).

Our investigation was focussed on the chemical nature of the incorporated nitrogen. Therefore, nitrogen molecules ($N_2{}^+$) and nitrogen radicals (N^+) have been implanted into the ZnO. The obtained films were investigated by XPS and NEXAFS. A comparison of the differently prepared films permits the assignment of photoemission peaks to chemical compounds of the nitrogen. Further investigations using N_2O as nitrogen source, showed a different composition of the chemical states of the incorporated nitrogen.

HL 14.2 Tue 9:45 BEY 154

Kelvin probe force microscopy imaging of cross-sections of Si multilayer structures — •Christine Baumgart[1], Anne-Dorothea Müller[2], Falk Müller[2], Manfred Helm[1], Andre Möller[3], and Heidemarie Schmidt[1] — [1]Institute of Ion Beam Physics and Materials Research, Forschungszentrum Dresden-Rossendorf, P.O. Box 510119, 01314 Dresden (Germany) — [2]Anfatec Instruments AG, Melanchthonstr. 28, 08606 Oelsnitz, Germany — [3]SGS Institute Fresenius GmbH, Zur Wetterwarte 10, 01109 Dresden, Germany

Kelvin probe force microscopy (KPFM) is a standard technique for the investigation of surface potentials. We present its applicability to cross-sectionally prepared p-p^+ Si multilayer structures. The contact potential difference (CPD) image between tip and sample has been recorded by means of an Anfatec Level-AFM with a 2nd amplifier and NSC15 probes from MikroMash. Using an active mixer, the excitation amplitude of the NSC15 probes is almost independent on the working frequency. The probed CPD signal difference between the layers ranges between 60 meV and 850 meV and can be correlated to the variation of the diffusion potential in the Si multilayer structure. The p-type of majority charge carriers and the corresponding acceptor dopant profile have been pinpointed by scanning capacitance measurements. Starting from the known donor dopant concentration in the NSC15 probe, we simulated the CPD and determined the acceptor concentration in the whole p-p^+ Si multilayer structure. From the frequency dependence of the CPD we can clearly distinguish between surface and bulk effects.