DF 6: High- and low-k-dielectrics (Joint Session with DS)

Time: Tuesday 10:30–11:50 Location: GER 37

DF 6.1 Tue 10:30 GER 37

Magnetoelectric effect in $FeCr_2S_4$ — •Martin Wohlauer, Stephan Krohns, Joachim Deisenhofer, Vladimir Tsurkan, and Alois Loidl — Universität Augsburg, Lehrstuhl für Experimentalphysik V, Universitätsstraße 1, 86150 Augsburg

The substance $FeCr_2S_4$ is a well investigated ferrimagnetic[1] spinel-type halfmetal[2]. Despite many publications describing effects in this compound over the last 50 years, the complex interactions of its many physical features leave many unanswered questions until today. Especially its magnetic and dielectric properties still show unreported effects. In this talk I'll present new measurements of dielectric constants under the influence of magnetic fields up to 7 Tesla, showing a magneto-electric coupling below 10 K. Kalvius *et al.*[3] presented evidence for a noncollinear spin structure below 40 K. The change of ϵ' by a magnetic field indicates a lowered crystal symmetry which may be caused by a helical spin configuration.

[1] G. Haacke *et al.*. *J. Phys. Chem. Solids*, **28**:1699 – 1704 (1967).
[2] M. S. Park *et al.*. *Phys. Rev. B*, **59**:10018 – 10024 (1999).
[3] G. M. Kalvius *et al.*. *J. Phys.: Condens. Matter*, **22**:052205(2010).

DF 6.2 Tue 10:50 GER 37

Barium silicate (Ba_2SiO_4) as high-k dielectric material — •Shariful Islam[1], Karl Hofmann[2], and Herbert Pfnür[1] — [1]Institut für Festkörperphysik (ATMOS), leibniz universität hannover — [2]Inst. f. Bauelemente der Mikroelektronik, leibniz universität hannover

In search of an alternative gate oxide, the structural and electronic properties of mixed Ba/Sr silicates on Si(001) were investigated. In order to specify the stoichiometry and band gap of these oxides we used X-ray Photoelectron Spectroscopy (XPS) and Electron Energy Loss Spectroscopy (EELS) respectively. Crystal structures were investigated by Spot Profile Analysis-Low Energy Electron Diffraction (SPA-LEED). Electrical characterization was done by CV and IV measurements.

Characteristics of high-k dielectric $(Ba_{0.8}Sr_{0.2})_2SiO_4$ and Ba_2SiO_4 were studied both on structured and unstructured samples. Both oxides are stable at high temperature and at ambient atmosphere. Crystalline $(Ba_{0.8}Sr_{0.2})_2SiO4$ has dielectric constant, $\varepsilon = 18 \pm 2$. The band gap was found to be 6.0 eV, with band offsets > 2eV both for valence and conduction band. The thick crystalline layers of pure $(Ba_{0.8}Sr_{0.2})_2SiO_4$ were also grown. An $\varepsilon = 19.6 \pm 0.4$, a small reduction of bandgap to 5.7 ± 0.1 eV and band offsets comparable to $(Ba_{0.8}Sr_{0.2})_2SiO_4$ were found. Due to our growth procedure (diffusion of Si into oxide) leakage currents are still comparatively high (0.1 A/cm^2 at 1V). Further electrical and structural properties of Ba_2SiO_4 will also be presented.

DF 6.3 Tue 11:10 GER 37

Comparison of different gate dielectrics for GaN based high electron mobility transistors — •Annett Freese[1], Stefan Schmult[2], Andre Wachowiak[1], and Thomas Mikolajick[1,2] — [1]NaMLab gGmbH, Nöthnitzer Str. 64, D-01187 Dresden — [2]TU Dresden, Institute of Semiconductor and Microsystems (IHM), Nöthnitzer Str. 64, D-01187 Dresden

The wide-bandgap and high electron mobility make gallium nitride (GaN) based heterostructures particularly interesting for future high-power switching applications. However, conventional GaN heterostructure field effect transistors (HFET) use a simple Schottky gate contact. Thus, they suffer from undesired high gate leakage currents and current collapse. To eliminate these challenges, a dielectric material can be placed between the gate electrode and the semiconductor. Aluminium oxide (Al2O3), hafnium oxide (HfO2), and zirconium dioxide (ZrO2) are potential candidates for such a gate dielectric material due to their high dielectric constant as well as their high conduction band offset to GaN. Learning from silicon processing technology, a successful integration of a suitable dielectric does not only depend on its material properties, but also relies heavily on the nature of the interfaces to the top and bottom electrodes. In this work we investigated Al2O3, HfO2 and ZrO2 with respects to their structural and electrical properties on GaN. The influence of the deposition methods, Molecular Beam Deposition (MBD) and Atomic Layer Deposition (ALD), on the film quality was studied.

DF 6.4 Tue 11:30 GER 37

Effect of different precursor for Atomic Layer growth of Ga2O3 using H2O as the oxygen source — •Sakeb Hasan Choudhury, Massimo Tallarida, Chittaranjan Das, and Dieter Schmeisser — Brandenburg University of Technology, Applied Physics-Sensors technology, Konrad-Wacshmann-Allee, 17, 03046 Cottbus, Germany

Atomic Layer deposition as a technique provides appropriate thickness control, conformality and Homogeneity. However, the contribution of Precursor and Substrate in the growth process is worth exploring and cannot be avoided as previously seen in case of Trimethyl Gallium. Ga2O3 is a member of group *Transparent Conducting Oxides*, hence possess immense potential in numerous applications. In this work, we would like to report about the growth of Ga2O3 using Tris-(dimethylamino)-gallium dimer and H2O as metal and oxygen precursors, respectively. Unlike Trimethylgallium, Ga2O3 films can be produced between temperature 200-300°C using Tris-(dimethylamino)-gallium dimer and it seems to be well compatible with H2O. These films were characterized by Synchrotron X-ray photoemission spectroscopy at BESSY/HZB, Berlin and subsequent analysis reveals stable film growth and absence of growth terminating phenomenon*s.