DF 15: High- and low-k-dielektrics (joint session with DS)

Time: Wednesday 9:30–10:30 Location: H11

DF 15.1 Wed 9:30 H11

Dielectric signature of charge order in lanthanum nickelates — •Pit Sippel, Stephan Krohns, Peter Lunkenheimer, and Alois Loidl — Experimental Physics V, University of Augsburg, Germany

The technical progress of electronics requires new materials which have enhanced electrical properties, are cheaper, and are composed of non-scarce elements. In the last years charge-ordered nickelates, due to their extraordinary high-dielectric constant, have been found to be promising materials for the use as dielectrics in capacitive circuit elements [1]. However, the mechanism giving rise to their high dielectric constants is still under debate. Therefore we have performed a thorough structural, magnetic, and dielectric investigation of various isostructural $La_{2-x}(Ba,Ca,Sr)_xNiO_4$ compounds. For commensurably charge-ordered nickelates, a correlation between electronic phase separation and the permittivity is observed [2]. The dielectric spectra of these compounds show a superposition of two relaxational processes. The stronger one is most probably related to a non-intrinsic effect. The second one seems to originate from an intrinsic process. To gain further insight into the origin of the mechanisms leading to the observed relaxation spectra, ceramics and singlecrystalline samples have been examined.

[1] S. Krohns et al., Nat. Mat. **10**, 899 (2011).
[2] P. Sippel et al., Eur. Phys. J. B **85**, 235 (2012).

DF 15.2 Wed 9:50 H11

Mixed Sr/Ba oxides as high-k dielectric material on Si(100) — •Shariful Islam[1], Karl Hofmann[2], and Herbert Pfnür[1] — [1]Institut für Festkörperphysik, Leibniz Universität Hannover — [2]Inst. f. Bauelemente der Mikroelektronik, Leibniz Universität Hannover

Mixed Sr/Ba oxide layers can be grown perfectly lattice matched as crystalline and epitaxial layers on Si(100). At a mixing Sr/Ba ratio of 30:70, a band gap of 4.3eV was found. Here we demonstrate that band alignment is possible both for p- and n-type Si with a band offset of > 1eV. Dielectric constants of 27 ± 1 were determined for layer thickness between 4 and 16 nm, corresponding to capacitance equivalent thickness (CET) between 0.5 and 2.6 nm. The capacitance-voltage curves in MOS diodes fabricated by covering the oxide layers with 100 nm of Au show small hysteresis (< 1 mV) indicating a small density of rechargeable traps in the oxide films. Trap densities at the Si/oxide interface were determined by the conductance method to be close to 4×10^{10} $eV^{-1}cm^{-2}$. These properties are coupled with low leakage currents (< 4 mA/cm^2 at 5 nm thickness). These electrically excellent properties contrast with its limited thermal stability. At temperatures above 450°C the oxides are transformed into a well defined and again crystalline $(Ba_{0.8}Sr_{0.2})_2SiO_4$, which turns out to be stable up to desorption above 750°C, forming a band gap of 6 eV. First electrical measurements on this material will be discussed, too.

DF 15.3 Wed 10:10 H11

Combinatorial Preparation of Dielectric Films — •Achim Walter Hassel and Andrei Ionut Mardare — Institute for Chemical Technologygy of Inorganic Materials, Johannes Kepler University Linz, Austria

Valve metals such as Al, Hf, Nb, Ta, Ti, Zr are well known sources for thin anodic oxide films that can be used as dielectrics. Al and Ta are used in capacitors, Hf is handled as the new gold standard for high-k dielectrics. Each of the oxides on the pure metals has its advantages and disadvantages. In an attempt to optimise these properties an new approach is presented. Binary and ternary thin film libraries of these metals are prepared as compositional spreads on glass or silicon. Using scanning characterisation techniques such XRF, XRD, EXD the parent metal properties are linked to the oxide formation data, its specific resistance and dielectric constant. All these information is extracted from a series of experiments performed using scanning droplet cell microscopy (SDCM). A comprehensive data set is generated for each of these libraries, showing how properties are depending on the composition.