3.9) are required. Using the high dielectric constant (high-k) material HfO_2 as a dielectric in MIM capacitor seems to be a very promising approach. Atomic Vapour Deposition (AVD*) technique was used for the preparation of hafnium oxide films on 20nm TiN/2nmSiO_2/Si (200mm) substrates using $Hf(NEtMe)_4$ precursor for MIM applications in back-end of line (BEOL). The influence of process temperature (320 - 425 °C) and process pressure (2-10mbar) on the structural and electrical properties of HfO_2 were investigated. The optimized dielectric layers obtained at 320 °C and 4 mbar possess k value of 18, capacitance density of 3.5 fF/μm^2 combined with required capacitance voltage linearity (<100 ppm/V^2) and quality factor of 50. Films with thickness of 35 nm exhibit leakage current density of $2\cdot10^{-7}$ A/cm^2 and breakdown strength of 5.8 MV/cm, therefore AVD* deposited HfO_2 layers are possible alternative dielectric candidates for MIM applications.

DF 5.6 Mon 16:40 WIL B321

Growth investigation of thin Ti-based high-k films — •Andreas Krause, Dominik Martin, Matthias Grube, and Walter M. Weber — namlab gGmbH, D-01187 Dresden

With the further increase in integration density of microelectronics, ordinary SiO_2-based stacks reach their limits as leakage currents increase significantly. Therefore, dielectric materials are required that combine a high dielectric constant (k) and low leakage currents, such as Ti-based oxides. Different titanates, like $HfTiO_x$ or $CaTiO_x$ with thicknesses up to 100 nm were deposited via an UHV sputtering tool. As substrates, n^{++}-Si-wafers were used as well as Si-wafers coated with TiN or noble metal (Ru, Pt) layers. The morphology was studied with atomic force microscopy and capacitor-voltage measurements were performed to extract the k-value.

DF 6: Poster I

Time: Tuesday 9:30–12:30 Location: P5

DF 6.1 Tue 9:30 P5

Atomic layer deposition and characterization of bismuth oxide thin films — •Philipp Moritz Leufke[1], Nicole Donia[2], Sanjay Mathur[3], and Horst Hahn[1] — [1]Institute of Nanotechnology, Karlsruhe Research Centre, D-76344 Eggenstein-Leopoldshafen, Germany — [2]Leibniz-Institute for New Materials, D-66123 Saarbruecken, Germany — [3]University of Cologne, Institute of Inorganic Chemistry, D-50939 Cologne, Germany

We report on the deposition of thin films of bismuth oxide by atomic layer deposition (ALD). We used bismuth *tert*-butoxide [Bi(O*t*Bu)$_3$] [1] as a bismuth precursor for the first time. H_2O serves as oxidizing precursor. Our aim was to overcome the problems caused by known precursors for bismuth containing oxides, which are often thermally unstable and require liquid-injection techniques or do not decompose entirely, leaving impurities in the resulting film [2].

Surface morphology and crystal structure of the prepared thin films are investigated by means of scanning electron microscopy and X-ray diffraction. Energy-dispersive X-ray spectroscopy and X-ray Photoelectron Spectroscopy are employed for chemical analysis. In our studies we show that the morphology dependends on various substrates and deposition parameters in these thin films.

[1] M. Mehring, *Coordination Chemistry Reviews, 19th Main Group Chemistry* **251**, 974-1006 (2007)

[2] M. Vehkamäki *et al.*, *Journal of Materials Chemistry* **14**, 3191-3197 (2004)

DF 6.2 Tue 9:30 P5

Electronic defect state mapping in strontium titanate by surface photovoltage and photoconductivity spectra — •Jana Becherer, Elke Beyreuther, Andreas Thiessen, Stefan Grafström, and Lukas M. Eng — Institut für Angewandte Photophysik, Technische Universität Dresden, D-01062 Dresden, Germany

Within the current interest in the field of oxide electronics, strontium titanate ($SrTiO_3$, STO) plays a crucial role as a substrate for the epitaxy of a wide variety of perovskite oxide films on the one hand and as a functional oxide by itself on the other hand. However, the electronic properties of STO – though having been the subject of research for several decades – are still not well understood for several reasons: (i) Firstly, the electronic properties change dramatically as a function of oxygen content, doping, or surface treatments, while (ii) secondly, standard electrical characterization methods fail due to the wide band gap and the consequently low carrier concentration. Thus optical techniques are the methods of choice for this kind of material.

In order to gain a more systematic understanding of surface and bulk electronic defect states, we performed a comparative study of the spectral, temporal, and temperature dependence of the surface photovoltage and the photoconductivity of undoped and doped STO single crystals. We discuss the defect state distribution within the framework of a classical band scheme.

DF 6.3 Tue 9:30 P5

Hyperfeinwechselwirkung in dünnen Schichten von HfO_2 — •Michael Steffens und Reiner Vianden — Helmholtz-Institut für Strahlen- und Kernphysik, Nußallee 14-16, 53115 Bonn

Der Einsatz von sogenannten "high-κ"-Dielektrika als Gate-Oxide in MOSFET-Strukturen gilt als eine der Möglichkeiten den Miniaturisierungsprozess in der Halbleiter-Industrie voranzutreiben. Als aussichtsreichstes Material wird dabei HfO_2 angesehen, wobei die thermische Stabilität problematisch bleibt.

In dieser Arbeit wird die Hyperfeinwechselwirkung des Hf in dünnen Schichten HfO_2 mit der gestörten γ-γ-Winkelkorrelation (PAC) untersucht. Die PAC eignet sich besonders für die Bestimmung der lokalen Umgebung eines Sondenkerns im Material. Die PAC-Sonde ^{181}Hf wird dabei entweder durch Neutronenaktivierung von ^{180}Hf erzeugt oder direkt in das Material implantiert. Zusätzliche Messungen werden mit der Sonde ^{111}In durchgeführt.

Die 100 nm bzw. 10 nm dünnen Filmproben sind mit ALCVD und MOCVD auf einem (100) Si-Substrat gewachsen. Im Mittelpunkt der Messungen stehen die Änderungen der Kristallstruktur in der Umgebung der Sonden während eines isochronen Ausheilprogramms und während temperaturabhängigen Messungen, die 'in-situ' stattfinden. Die Ergebnisse der Messungen an diesen dünnen Schichten werden mit Messungen an reinem HfO_2 verglichen.

DF 6.4 Tue 9:30 P5

Development of a precisely tuneable continuous-wave THz spectrometer with interferometric frequency control — •Holger Schmitz[1], Joachim Hemberger[1], Anselm Deninger[2], Axel Roggenbuck[2], and Markus Grüninger[1] — [1]II. Physikalisches Institut, Universität zu Köln, Zülpicher Str. 77, D-50937 Köln, Germany — [2]TOPTICA Photonics AG, Lochhamer Schlag 19, D-82166 Gräfelfing, Germany

We will report on the development of a precisely tuneable continuous-wave THz spectrometer with interferometric frequency control. The system is based on mixing two near-infrared distributed feedback diode lasers, the beat of which can be tuned continuously from 0 to 1.2 THz. Each laser is stabilized by electronic feedback from a low-finesse Fabry-Perot etalon, yielding a laser linewidth of roughly 1 MHz and a frequency precision of a few MHz. The laser beat is converted into THz radiation by a photoconductive switch, which efficiently generates THz radiation from 20 GHz to 1.2 THz. The THz radiation is detected via a second photoconductive switch via homodyne mixing of the THz signal and the laser beat. The coherent homodyne detection preserves the phase information of the THz electric field, so that both the real and the imaginary part of the dielectric function, ε_1 and ε_2, can be determined. Making use of different optical path lengths for the laser beam and the THz radiation, the phase shift due to the sample can be determined by sweeping over an interference fringe, typically a few 100 MHz. Thus ε_1 and ε_2 can be determined without mechanically moving parts. First results obtained with this system will be reported.

DF 6.5 Tue 9:30 P5

The electronic band diagram of thin PrO2(111) / Pr-silicate buffers on Si(111) and its relevance to dielectric properties — •Olaf Seifarth[1], Christian Walczyk[1], Grzegorz Lupina[1], Peter Zaumseil[1], Dieter Schmeisser[2], Hans-Joachim Müssig[1], and Thomas Schroeder[1] — [1]IHP, 15236 Frankfurt, Im Technologiepark 25 — [2]BTU Cottbus, 03046 Cottbus, Konrad-Wachsmann Allee 17

Thin dielectric buffers of cubic PrO2(111) on Si(111) are ideally suited to integrate Ge onto Si by moderating the lattice mismatch between the