

Swedish Center for III-Nitride Technology

Next Board Meeting 11 March, 2019 at LiU

As a part of C3NiT education activities, a PhD course on **Electrical Characterization of Semiconductor Devices** is given at LiU, Dec'18 – Feb'19, by Walter Meyer (University of Pretoria) and Einar Sveinbjörnsson (University of Iceland & LiU).

We welcome a new Center Communication Coordinator - **Roger Magnusson**. He will assist with coordination on reporting, follow ups on operational plans, C3NiT website, communication and outreach.



PROJECT UPDATES



New hot-wall MOCVD reactor: Gandalf has been installed at LiU. Tests on flowing heat and active gases have been successfully performed. *Kevin Olsson*, an industrial Master student, works together with Epiluvac, SweGaN and LiU on optimizing gas flow profile.

HEMT technology: The impact of the *channel thickness* was investigated using an InAlN/AlN/GaN/AlGaIn HEMT structure. A thickness of 100nm was shown to give the best compromise between short-channel effects and electron trapping in the back-barrier. A new method of more directly measuring drain-induced barrier lowering (DIBL), which is a measure of short-channel effects, has been established.

Improved Ohmic contacts: Chalmers has demonstrated that deeply recessed contacts are a viable strategy for defining ohmic contacts. Recent results show that the method can produce ohmic contacts below 0.2 W-mm.

p-type doping via Mg implantation: LiU has been developing novel oxide cap of GaN layers for activation of Mg doping. These caps have been successfully tested for thermal annealing up to 1250 °C. Mg implantation and subsequent annealing of capped GaN has been performed at NRL, and currently under evaluation.

GaN MMIC: A BCB/metal stack containing 4-5 metal layers with thicknesses of 0.5 to 2 μm, and BCB layer thickness of 10 μm has been defined. This stack allows potentially for antenna integration on top. Tests of fabricating the stack are on-going. Saab has designed a series of test-structures to assess the technology.

C3NiT Day – Project Discussions 4 December, 2018 at LiU



Twenty C3NiT members met at LiU to discuss progress and plan work within the projects on Advanced Epitaxial Growth Development and Vertical GaN Power Devices. Invited lectures on *Electrical characterization of III-Nitride semiconductor materials and devices* have been presented by Walter Mayer (University of Pretoria) and Einar Sveinbjörnsson (University of Iceland & LiU). Muhammad Nawaz presented an overview of *Power semiconductor portfolio at ABB*.



RESEARCH HIGHLIGHTS

Manuscript Disclosures

Recombination processes in Mg doped wurtzite InN films with p- and n-type conductivity by LiU and SweGaN (AIP Advances)

Recent Publications

A. Malmros et al., "Impact of Channel Thickness on the Large-Signal Performance in InAlGaIn/AlN/GaN HEMTs With an AlGaIn Back Barrier", IEEE Transactions on Electron Devices, 2018, doi=10.1109/TED.2018.2881319

T. Huang, H. Jiang, J. Bergsten, K. M. Lau, N. Rorsman, "Enhanced gate stack stability in GaN transistors with gate dielectric of bilayer SiNx by low pressure chemical vapor deposition", Applied Physics Letters, vol. 113, 232102, 2018. doi 10.1063/1.5042809

Presentations at the International Workshop on Nitride Semiconductors, IWN2018 Nov 2018, Kanazawa, Japan

Jr-T. Chen "A revolutionary GaN-on-SiC epitaxy for power electronics", IWN2018 (Talk)

P. Sukkaew "Control of growth mode and strain in Al-rich AlGaIn in hot-wall MOCVD" (Poster)

H. Zhang "Comparative study of GaN grown onto on-axis and vicinal SiC(000-1) substrates by hot-wall MOCVD" (Poster)