

## Swedish center for III-Nitride Technology

First Board meeting was on March 8<sup>th</sup>, 2018 in Linköping University

**Next Board Meeting: June 7<sup>th</sup>, 2018 in Chalmers at 10:00**

### SME CALL FOR PROPOSALS

SMEs within C3NiT are invited to submit research proposals within the *Competence Center – support for SME* call to the Board. The research proposals should follow the format according to VINNOVA guidelines.



Anna Aspgrén has been approved by the Board as a new Center Board member. Anna has an MSc in Mechanical Engineering from Chalmers University of Technology. She is an Innovation Advisor responsible for the Innovation Office Verification Funding.

## C3NiT BOARD APPROVES PROJECTS

### P1. Advanced Epitaxial Growth Development

Led by Jr-Tai Chen (LiU)

Develop controllable growth of thick low-doped Ga(Al)N epitaxial layers on SiC and GaN, N-polar III-Nitride epitaxy and GaN regrowth in trench structures by hot-wall MOVPE.

#### Ongoing Activities

1. N-polar III-N epitaxy by hot-wall MOVPE.
2. High-Al-content thick AlGaIn layers on SiC.

#### Planned Activities

1. Developing thick GaN layers.
2. Reduce background doping below  $10^{16} \text{ cm}^{-3}$ .
3. Reactor modeling.

### P3. Lateral HEMTs for RF and Power Application

Led by Niklas Rorsman (Chalmers)

Investigate III-Nitride HEMTs in terms of epitaxial design, growth, transistor layout and processes. Characterize devices for basic properties to understand limiting factors. Identify measurement methods to characterize the devices in view of applications.

#### Ongoing Activities

1. Impact on large signal performance of back-barrier design in InAlN/AlN/GaN HEMTs.
2. Optimization of silicon nitride passivation by low pressure CVD.
3. Lateral power HEMTs: Field-plate optimization and comparison of Si and SiC substrates.
4. Characterization of downscaled GaN HEMTs (lg down to 50 nm).

### P2. Vertical GaN Power Devices

Led by Olof Kordina (SweGaN)

Develop novel scalable and adaptive III-Nitride material technology for vertical Ga(Al)N on GaN and SiC junction barrier diodes and switches for medium (up to 1.2 kV) and high (above 1.2 kV) voltage ranges.

#### Ongoing Activities

1. AlGaIn conductive nucleation layers.

#### Planned Activities

1. Device modeling.
2. Thermal conductivity optimization.
3. GaN on GaN.

### P4. MMIC Technology

Led by Anna Malmros (Chalmers)

Advances in III-Nitride HEMTs in "Lateral HEMTs for RF and power"-project will be implemented in the MMIC-process at Chalmers, where we initially aim for MMICs working up to D-band.

#### Ongoing Activities

1. Improvements in backside processing (new bonding material).

#### Planned Activities

1. Initial process tests of BCB-layers.
2. New design-kit.
3. MMIC-tape-out in Fall 2018.

## RECENT FUNDING: SSF Award of 35 MSEK for 2018-2022

Low-defect-density III-Nitrides for Green Power Electronics

LiU in partnership with Chalmers, Lund University, SweGaN, Hexagem, On Semiconductor, and ABB

Will develop low-dislocation-density nanowire-based GaN and AlGaIn wafers and subsequent homoepitaxy of device structures for vertical Ga(Al)N on Ga(Al)N junction barrier diodes and switches in the 600 V - 5 kV range and beyond. The project will be kicked-off on 8th of May at Chalmers.

## RESEARCH HIGHLIGHTS



**C3NiT recruitments:** Hengfang Zhang PhD student; Pitsiri Sukkaew and Alyssa Mock – post doc fellows. Five more PhD student positions and one post doc position are being open.

**Crack-free 1.5  $\mu\text{m}$ -thick  $\text{Al}_{0.8}\text{Ga}_{0.2}\text{N}$  on SiC has been demonstrated.**

**Good quality N-polar AlN on on-axis and vicinal SiC have been developed.**

**A revolutionary GaN-on-SiC epitaxy for high-frequency power transistors** by SweGaN is presented at GaN Marathon April 18-19<sup>th</sup> 2018, Padova.

**Disclosure:** "A versatile low-resistance ohmic contact process with ohmic recess and low-temperature annealing for GaN HEMTs" by Chalmers, LiU and SweGaN (Semiconductor Science and Technology).

**Ph. D. dissertation** on April 27<sup>th</sup> in Chalmers: Johan Bergsten "Buffer Related Dispersive Effects in Microwave GaN HEMTs."; Opponent: Prof. Gaudenzio Meneghesso, University of Padova.