Master / Bachelor Thesis
at Compound Semiconductor Technology (CST)

Fabrication and characterization of lateral HEMT on carbon-doped GaN buffers

GaN is well suited for the realization of lateral HF transistors, which utilize the high mobility of a two-dimensional electron gas (2DEG) at an AlGaN/GaN interface. The schematic on the left-hand side shows such a HEMT.

Based on the HEMT concept, the fabrication of vertical GaN power devices is to be investigated. In a first step, the vertical conductivity of carbon-doped buffer layers will be investigated. An insulating buffer layer is required to suppress leakage, both for lateral HEMT as well as vertical devices. The conductivity of this layer can be tuned by modifying the doping concentration $N_{A,C}$ as well as the layer thickness during MOCVD. The vertical conductivity will be analyzed using simple test structures, as shown below as a schematic cross section and in the SEM image.

In the second step, depending also on progress and available time for the thesis, the optimized layer will then be used to fabricate HEMT. For this purpose, the AlGaN/GaN heterostructure is deposited on the buffer layer by MOCVD, followed by the processing and characterization of the complete device. Standard growth processes as well as deposition methods modified for vertical device designs will be compared.

Your task includes the processing of the test structures and the HEMT, e.g. by using tools for plasma-assisted dry etching and electron-beam metal evaporation. This work, as well as the electrical characterization of the components, can be carried out in our clean room at the Zentrallabor für Mikro und Nanotechnologie, of course with our support.

Prior lab work experience is not required, however willing to work hands-on in the lab and enjoying to work independently as well as interest in semiconductor physics and devices are beneficial.