

Bachelor Thesis Task in the NanoEngineering Program

Topic: Optimization of p+ doped arsenide layers for application in MOCVD-grown InP DHBT structures

Task:

Highly p-doped thin layers of InGaAs or GaAsSb are required for high-performance InP double heterojunction bipolar transistors (InP DHBT), with applications in wireless communication systems at 140 GHz and above. The commercialization of InP DHBT technology requires the development of crystal growth procedures for this material system on a large diameter wafer scale, and with high throughput. Specifically, the Metal-organic chemical vapor deposition of InP/InGaAs/InP and/or InP/GaAsSb/InP heterostructures is targeted here. Within the scope of the bachelor thesis, the activated p-doping concentration in the base layer of 20-40 nm thickness is required to reach $6 \times 10^{19} \text{ cm}^{-3}$. The growth temperature is constrained by the material combination in the entire epitaxial stack including n-doped InGaAs and InP. The tasks to be performed in this B.Sc. thesis are summarized as follows:

- 1) calibration of growth conditions for p-InGaAs or p-GaAsSb lattice matched to InP, with sufficient uniformity for targeted thickness range of 20-40 nm
- 2) verification of crystal quality by X-ray diffraction (XRD)
- 3) measurement of activated dopant concentration by ECV profiling
- 4) validation of activated dopant concentration including the full thermal budget of InP DHBT epitaxy