Comparison of different fabrication methods to realize p-GaN-gated normally-off AlGaN/GaN HEMTs

High electron mobility transistors (HEMTs) are an important topic of compound semiconductor research. Due to their superior carrier mobility and large breakdown voltages, these transistors are attractive for high-power applications. HEMTs achieve this high mobility through a two-dimensional electron gas (2DEG), formed at the interface of the AlGaN/GaN heterojunction. Due to this 2DEG, HEMTs are typically of normally-on type and have to be actively pinched-off by applying a negative gate voltage. However, normally-on devices are preferable in order to ensure safe operating conditions.

In this work, such devices shall be realized using a p-GaN gate, which depletes the 2DEG. Different methods regarding the structuring of the p-GaN layer will be compared. These methods include classical etching (1), p-GaN passivation via hydrogen plasma treatment (2), and p-GaN regrowth (3).

Part of your responsibilities will be the processing of such HEMTs in our cleanroom in the Central Laboratory for Micro- and Nanotechnology. You will become acquainted with different processing techniques such as lithography, electron beam evaporation, and reactive ion etching. Finally, you will electrically characterize and evaluate your fabricated devices.

Previous knowledge is not necessary, but it is helpful if you are interested in semiconductor physics and enjoy working independently in the laboratory.