

Bachelor Thesis Task in the NanoEngineering Program
Topic: Process Development for Emitter Base Diode of InP HBTs

Task:

To realize electrical terahertz circuits, active components with a sufficiently high cutoff frequency are required. A promising component for this purpose is heterostructure bipolar transistors (HBT) based on III/V semiconductors, which currently can achieve cutoff frequencies of up to 1.2 THz. A direct approach to increasing the cutoff frequency of HBTs is miniaturization of the device. In this context, the dimensions of the emitter and base mesa are crucial. To achieve the smallest dimensions, electron beam lithography (E-beam lithography) is suitable, as it offers not only very high resolution but also the necessary flexibility in the produced structures, which is essential for device development.

In previous works, the parameters (including a proximity correction) for the writing process of the emitter and base structures of the HBT have been determined via electron beam lithography.

The goal of this thesis is to develop a process for the fabrication of the emitter-base diode for HBTs based on these parameters. This includes determining and optimizing the accuracy of alignment with respect to overlap and rotation errors of the successive lithography steps. Furthermore, the objective is to find suitable process parameters for the metallization and etching steps to ensure that the best possible contact resistances are achieved while simultaneously avoiding short circuits. The structures produced in this way will be examined using electrical measurements, such as TLM (Transmission Line Model) or four-point measurements, as well as scanning electron microscopy.