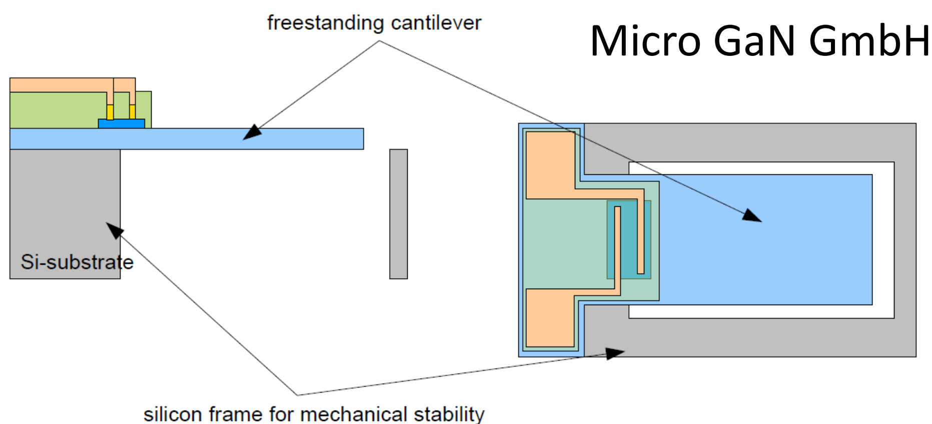
GaN MEMS structures

Micro-electromechanical systems (MEMS) are mechanical systems with dimensions in the micrometer range that couple mechanical and electrical properties of the structures. They are thus active devices that can be either sensors of actuators. We are surrounded by this type of devices in our daily life, for instance mobile phones, computers, cameras, cars, etc, and the fields of applications are constantly growing. By far the most MEMS are based on Si and fabricated with standard Si process technologies. This, however, may require modifications of the electrical properties of Si to facilitate fabrication of active devices. In this project the possibilities for fabrication of MEMS based on GaN nitride films which show strong piezoelectric effects will be investigated.

GaN nitride crystalline films, approximately 500 nm thick, grown on Si(111) will be the starting point of MEMS fabrication in the project. Cantilever structures can be defined by e-beam lithography. Recipies for etching into the GaN layer, probably by reactive ion etching, must be developed. This must be followed by etching into the Si layer and removal of the Si below the GaN cantilevers by isotropic chemical etching. Having fabricated free standing GaN cantilevers their elastic properties can be tested by various way of bending them.

The next challenge is to deposit electrical contacts on the cantilevers. With proper markers on the wafers repeated lithography steps can be used to define contact areas that can be used to form the contacts through a lift-off process. With these contacts an active piezoelectric sensor and actuator has been produced. A detailed characterization of the device should be carried out.



Review of GaN MEMS: Journal of Microelectromechanical Systems, **23**, 1252 (2014)