

Piezotronic effect influence on the operation of the electronic devices fabricated in AIIIN nanostructures

At present moment, to manufacture electronic components and optoelectronic devices various semiconductor materials are used. For commercial electronic applications most common material of choice is silicon, which is widely used for fabrication of processors and large-scale of integration systems. In contrary, the material used for fabrication of white and blue light emitting diodes (LED) is gallium nitride. Gallium nitride is also used to produce transistors that can operate at high frequencies (tens of GHz). Such transistors are used, among others, in fourth generation base transceiver stations. More and more often GaN-based transistors are also used in radars. Gallium nitride is a piezoelectric material. This means that under the influence of forces, there is an electric charge formed on the surface (this effect is called the direct piezoelectric effect). Yet, if the material is influenced by applied electric field it will deform (converse piezoelectric effect).

The goal of the project will be to investigate the impact of the piezoelectric effect on the performance and properties of microwave transistors fabricated in nitride of the third group of the periodic table nanostructures. The piezoelectric effect can be used to design other electronic components (e.g. force sensors).

The project tasks also include researching the phenomena that occurs in electronic devices, focusing on metal-semiconductor contact, under the impact of external forces. This kind of instruments, in which controlling current flow can be performed by external force, are called piezotronic transistors.

Devices under test will also include a group of devices in which the primary phenomena utilized is the formation of acoustic waves in the piezoelectric semiconductor.

The results obtained within project scope, will enable the design and fabrication of new piezotronic devices and devices that take advantage of acoustic waves formation. Piezotronic and piezophotonic are considered to be new areas of science.