

Most of the HgCdTe devices in the p-on-n, n-on-p, or multilayer architecture are fabricated by mesa geometry using wet chemical or plasma etching techniques. The mesa definition etch process induces undesirable changes in HgCdTe surface properties. In narrow bandgap materials these surface changes could deteriorate a device performance. Uncontrolled band bending (dangling bonds) occurred on the slopes of the active layer increase of the recombination velocity causing surface leakage current. Adequate passivation is essential to minimize the effects from the surface states by saturating them.

The main objective was to estimate the ratio of bulk current to parasitic leakage currents - usually flowing on the mesa slope. The aim of the project is to carry out research work in determining of the construction and development of infrared detectors technology with limited influence of surface leakage currents and the confrontation of experimental results with calculated by using numerical programs. The research will involve to determination of the detectors shape and area effects, as well as etching process: methods, depth, profile on the surface effects. The last step will be to determine the effect of passivation on the final parameters of the instrument. The research will be carried out on detectors made from HgCdTe working without cryogenic cooling (HOT) and optimized for the mid-infrared range (*Mid-Infrared Wavelength* - MWIR). These devices could be easier implemented in many higher operation temperature applications where the necessity of cryogenic cooling of IR detectors is impossible to obtain. This will allow to use such detectors in widespread application where the necessity of cryogenic cooling of IR detectors is impossible to obtain, for example military, sensors at airports prevent terrorist attacks, etc.

The project is scheduled to realize following tasks:

- I. Performance of HgCdTe detector structures with different geometry (photolithography, etching using dry (RIE) and wet method to compare the effect etchants for density unsaturated broken bonds, passivation by electrochemical or other available technique of passivation, example: sputtering of CdTe material).
- II. Characterization of obtained structures.
- III. Verification of experimental results of electrical parameters for obtained structures of mesa type by numerical simulations and quantitative determination of surface leakage currents.