A STUDY OF CARRIER COLLECTION IN GaS – BASED X-RAY AND γ- RAY DETECTORS BY PHOTOELECTRIC METHOD

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Semiconductor detectors (SD) are the most perspective materials in optoelectronics because of small size of active area and possibility of providing high sensitivity by means of creation of highly active area. Semiconductors A^3B^6 are perspective materials for x-ray and γ– ray SD. These semiconductors are interesting that high photoconductivity in the ultraviolet spectrum, surpassing the edge is observed in them.

One of main parameters of x-ray and γ - ray SD is efficiency of charge carrier collection. Research of problems of carrier collection in A^3B^6 – based x-ray and γ - ray detectors is now actual as in these detectors lifetime of carriers is much less, than in other semiconductors and in order to collect carriers at small thickness (1-2 mm) of crystal it is important to put a high voltage (100-300 V).

In the present work charge carrier collection in x-ray and γ - ray detectors on the basis of metal - p-GaS is investigated. The principle of action of SD is based on generation of electron-hole pairs in contact with metal-semiconductor and their collecting at the enclosed back displacement pressure. Optimal values of the sample thickness, intensity of electric field enclosed to contacts and energy of photons of falling light at which it is possible to provide effective work of the detector are defined. Calculation of photoconductivity (PC) depending on intensity of electric field and light absorption is carried out.

The spatial distributions of nonequilibrium electrons □n (x) on a thickness of a crystal are analyzed at their excitation at various values of absorption coefficient: □= 1 sm^{-1}, □= 10 sm^{-1}, □= 100 sm^{-1}. At generation of electrons with small values of absorption coefficient (□= 1 sm^{-1}) nonequilibrium electrons are distributed at zero displacement (V=0) more or less irregularly on a thickness of a crystal. At imposing the external field photoexited electrons can get into depth of a crystal. For effective work of the detector pressure of displacement is put so high that all exited electrons reach a back electrode.

It was established that PC at small values of photon energy (h□) at negatively charged irradiated surface increases together with increase in pressure, and decreases at opposite polarity of the enclosed pressure. At big values of h□ PC decreases to limiting value with increase in pressure, then the edge PC increases for four orders. Besides, with increase in pressure the edge of PC moves to short-wave edge. Optimal values of parameters have been defined at which the maximum of PC is observed.

On the basis of the spent researches we may come into conclusion that it is possible to create the x-ray and γ- ray detectors on the basis of metal - p-GaS which will have high sensitivity and rapid.