# DYNAMICS OF THE FORMATION OF PHOTOCURRENT PULSES OF MICROSTRIP SENSORS BASED ON CHROMIUM-COMPENSATED GALLIUM ARSENIDE UNDER THE INFLUENCE OF SYNCHROTRON X-RAY RADIATION*

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Currently, synchrotron radiation sources occupy a leading position in the development of modern science and technology. To register synchrotron radiation, ionizing radiation detectors based on semiconductor materials are widely used, which have significantly better spectrometric characteristics compared to gas and scintillation counters. Today, chromium-compensated gallium arsenide (HR-GaAs:Cr, where HR is high resistivity) has proven itself well as a detector material. The technology developed by scientists from Tomsk to compensate GaAs n-type conductivity with chromium in the process of high-temperature diffusion makes it possible to obtain radiation-resistant HR-GaAs:Cr (HR – high resistivity) structures with a resistivity of the order of $10^9$ Ohm×cm and an active region thickness of up to 1 mm [1,2].

At the moment, there are no results in the literature studying the mechanisms of current flow in HR-GaAs:Cr structures under the influence of synchrotron X-ray radiation. For these purposes, a comprehensive study was carried out, consisting of an experimental and computational part. The experiment was carried out at the VEPP-4M electron-positron collider. HR-GaAs:Cr microstrip sensors were irradiated with synchrotron radiation pulses with a duration of 100 ps. The maximum of the synchrotron radiation spectrum corresponded to a photon energy of 20 keV. Fig. 1 shows one of the measured photocurrent pulses of the HR-GaAs:Cr sensor at an anode voltage (solid contact) of 1000 V. The duration of the main part of the pulse at the FWHM level is about 5 ns. The observed photocurrent oscillations at the trailing edge of the pulse are likely due to the presence of parasitic inductance between the sensor strip and the cable leading to the oscilloscope. In the main part of the pulse, 3 characteristic peaks with a duration of about 0.5 ns are observed. To quantitatively explain the mechanisms of the formation of photocurrent pulses of the HR-GaAs:Cr sensor when irradiated with synchrotron radiation, numerical modeling was carried out in the computer-aided design system for semiconductor devices COMSOL. Modeling of photocurrent dynamics was carried out under irradiation with single pulses of X-ray radiation with an intensity of 6000 W/cm$^2$ and photon energies from (10 – 60) keV. Calculations have shown that the formation of 3 photocurrent peaks is associated with electron drift in an inhomogeneous field screened by electron-hole plasma in the absorption region

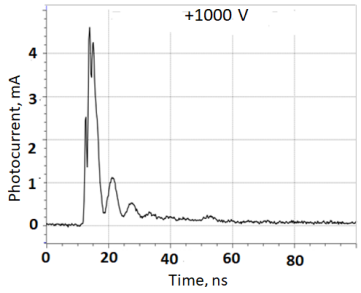


Fig.1. Photocurrent pulse of an HR-GaAs:Cr sensor when irradiated by a flash of synchrotron radiation

REFERENCES

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