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SELF-POWERED PHOTODIODE BASED ON Ga_2O_3/N-GaAs STRUCTURES*

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The electrical and photoelectric characteristics of Ga_2O_3/n-GaAs structures obtained by RF-magnetron sputtering of a gallium oxide film on gallium arsenide epitaxial layers with an electron concentration of $N_d = 9.5 \cdot 10^{14}$ cm^{-3} are studied. The structures were annealed in argon for 30 minutes at a temperature of 900°C, after the deposition of the Ga_2O_3/n-GaAs oxide film.

Platinum contacts were deposited on the Ga_2O_3 surface and the rear side of the semiconductor substrate to measure the electrical characteristics. The contact to the semiconductor was deposited in the form of a continuous metal film, and the contact to gallium oxide was created by metal deposition through masks 1 mm in diameter. The area of the electrode to Ga_2O_3 (gate) was 1.04 cm^{-2}.

The dark current-voltage characteristics of the samples (I_D) are nonlinear and are determined by the polarity and magnitude of the gate potential. The rectification factor at voltages of ± 4 V is 10^3.

The forward current decreases, and the reverse current increases under UV exposure (Fig. 1). The most noticeable effect of radiation with λ = 254 nm is observed at low positive and negative voltages on the sample, in the vicinity of $U \approx 0$ V.

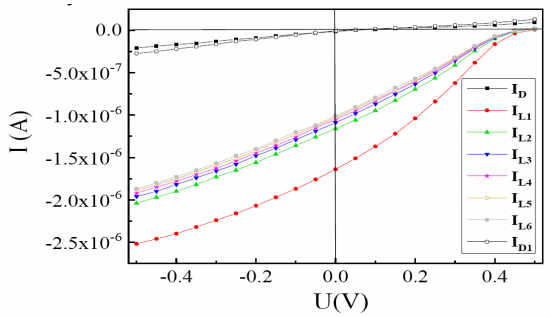

Fig.1. Current-voltage characteristics of the sample at positive and negative potentials on the gate: dark (I_D) and under exposure of radiation with λ = 254 nm (I_{L1}-I_{L6}).

The largest changes in the forward and reverse currents under UV radiation are observed at the first measurement of the detector (I_{L1}). A decrease in the photocurrent I_{ph} was found during subsequent measurements of the I-V characteristics under continuous exposure to UV radiation (Fig. 1, curves I_{L2}–I_{L6}).

The studied M/Ga_2O_3/n-GaAs structures reveal the properties of photodiodes. The reverse current increases by more than two orders of magnitude under UV radiation and voltage U = -0.012 V. It makes possible to use such structures as detectors of UV radiation in the wavelength range of 200–280 nm. The photocurrent is 1 μA at U = 0 V (Fig. 1).

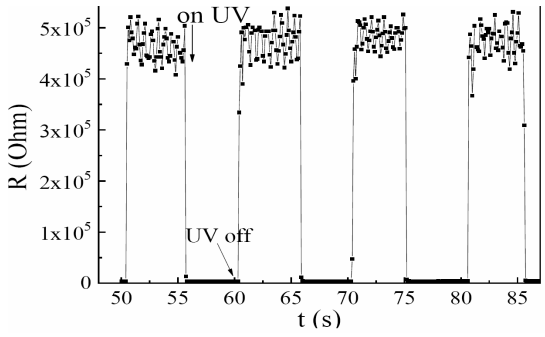

Fig.1. Time dependences of the change in the resistance of the M/Ga_2O_3/n-GaAs structure.

Measurements of the time dependences of the change in the conductivity of the samples upon turning on and off the radiation with λ = 254 nm showed that the response and recovery times do not exceed 1–2 seconds (Fig. 2).

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