PULSE CHARACTERISTICS OF IONIZING RADIATION SENSORS BASED ON HR-GaAs:Cr*

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The appearance of the first sensors for recording ionizing radiation opened a number of promising applied and scientific disciplines. Currently, such sensors are widely used in such areas as medicine, high-energy physics, non-destructive testing, inspection systems and astrophysics. Modern sensors can be divided according to the principle of operation and the materials that are the basis for the creation of such devices. Gas-discharge sensors are relatively accessible, but their use is severely limited due to the low density of the active region (gas). Such sensors are not able to effectively absorb radiation and therefore solid-state structures, where the density of the substance is much higher, are more preferable. Solid-state sensors include scintillators operating on the principle of indirect registration. The conversion of radiation energy into an electrical signal occurs in two stages, so the efficiency of such devices remains low. The development of the semiconductor industry has made it possible to use semiconductor elements as the basis for creating sensors for recording ionizing radiation. Potentially, semiconductor sensors do not have the disadvantages that are typical for gas sensors and scintillators. It is worth noting that there is particular interest in high Z (where Z is the atomic number) semiconductor materials. Such materials include semiconductors of complex composition, such as CdTe or GaAs. Today, the synthesis of CdTe is a particularly complex technological process, which leads to the high cost of these structures. An alternative material is GaAs, which is widely used in many areas of microelectronics, and the method for its production has been debugged at a high level. The limiting factor in the use of GaAs as sensors is antisite defects (EL2-centers). In the ionized state, EL2-centers have a huge electron capture cross section, which significantly limits the functionality of GaAs sensors. A group of scientists from Tomsk State University has proposed a method that makes it possible to obtain GaAs structures of detector quality. This method is based on compensation of the initial donor impurity with a deep acceptor (chromium). Numerous studies have shown that high-resistivity GaAs, compensated with chromium (HR-GaAs:Cr) can become the basis for the creation of new generation detector systems [1-5]

Within the framework of this work, the pulse characteristics of HR-GaAs:Cr sensors were studied in detail. The experiment was carried out based on measuring the response of HR-GaAs:Cr sensors to pulsed radiation of various frequencies. In this case, radiation was used, which ensured the near-surface generation of charge carriers in the structure of the semiconductor. This made it possible to describe the process of charge carrier transport in the studied HR-GaAs:Cr structures

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