Admittance of barrier nanostructures based on MBE HgCdTe

***Izhnin I.I.*[1], Voitsekhovskii A.V.[2], Nesmelov S.N.[2], Dzyadukh S.M.[2], Dvoretsky S.A.[2,3], Mikhailov N.N.[3], Sidorov G.Yu.[3], Kurbanov K.R.[4]**

[1] Scientific Research Company "Electron-Carat".
Stryjska St., 202, Lviv-79031, Ukraine.
E-mail: i.izhnin@carat.electron.ua

[2] National Research Tomsk State University.
Lenina Av., 36, Tomsk-634050, Russia.

[3] A.V. Rzhanov Institute of Semiconductor Physics of SB RAS.
Lavrent'ev Av., 13, Novosibirsk-630090, Russia.

[4] Kremenchug Flight College.
Pobedy St., 17, Kremenchug-39600, Ukraine.

In recent years, the development of infrared barrier detectors has intensified (for example, in the nBn configuration [1]), which is associated with the possibility of reducing noise by suppressing some components of the dark current. The greatest success so far has been achieved in the creation of detectors based on III-V compound. The use of HgCdTe-based barrier detectors provides significant technological advantages due to the possibility of eliminating the defect-forming ion implantation procedure. This paper presents the results of studies of the admittance of barrier nanostructures based on HgCdTe obtained by molecular beam epitaxy.

For studies, nBn structures with various barrier layer designs (wide-gap materials with various compositions and superlattices) were fabricated. The admittance of nBn structures, as well as MIS devices based on nBn structures, was studied. Equivalent circuits for nBn structures of various types were proposed. The dominant dark current mechanisms for structures with various barrier layers were established. It was shown that the study of the admittance of MIS devices based on the nBn structure makes it possible to determine the value of the differential resistance of the barrier in a wide range of conditions. The differential-resistance-area product values are determined under different temperatures and biases. It was found that in superlattice nBn structures, the barrier for minority charge carriers decreases, which should lead to an increase in responsivity.

1. Istuno A. M., Phillips J. D., Velicu S. Mid-wave infrared HgCdTe nBn photodetector // Appl. Phys. Lett.-2012. - 100. - P. 161102 (1-3).