Some Methodological Aspects of Studying Ohmic Contacts to *n*-InP

Novytskyi S.V.

V. Lashkaryov Institute of Semiconductor Physics, NAS of Ukraine, Kyiv, Ukraine;

Currently InP Gunn diodes are widely used in radar systems, radio spectroscopy, telecommunications, for road accident prevention etc. [1, 2]. Stable operation of Gunn diodes under extreme conditions puts special requirements on ohmic contacts connecting the devices into a circuit. Therefore, these contacts must be resistant to different actions and maintain low contact resistivity at Gunn diode operating temperatures.

The problem of contact thermal stability can be solved by applying contact metallization with a diffusion barrier that prevents mass transfer in the contact metallization. We studied the contact structure Au/TiB_2/Au/Ge/n-n^+-n^{++}-InP with a TiB_2 layer serving as diffusion barrier. An Auger analysis showed diffusion stability of TiB_2 at annealing (formation) temperature of 400–490°C. In this case, the contact resistance value did not change.

We studied also how the contact resistivity ρ_c of ohmic contacts Au/TiB_2/Au/Ge/n-n^+-n^{++}-InP depended on the ambient temperature T. An uncharacteristic (growing) dependence $\rho_c(T)$ at diode operating temperatures was obtained. This dependence is well described with the model for current flow via metal shunts that were formed at the metal-semiconductor interface due to In atoms deposition on structural nonuniformities [3]. After microwave irradiation of the contact structures (frequency of 2.45 GHz, irradiation of 7.5 W/cm^2), the contact resistivity decreased and was uniformly distributed over the contact area. This may be caused by local heating at the defects that leads to redistribution of In atoms in the semiconductor near-surface region.

1. H. Eisele, R. Kamoua. Submillimeter-Wave InP Gunn Devices. IEEE Trans. Microw. Theory Techn. - 2004. - 52, no 10. - P. 2371-2378.
2. H. Okazaki, T. Sato, N. Yoshizawa, T. Hashizume. Optical and electrical properties of InP porous structures formed on ***p-n***-substrates. Proc. 22nd 2010 Intern. Conf. "IPRM-2010". - Japan, Kagawa. - 2010. - P. 77-80.
3. A.V. Sachenko, A.E. Belyaev, N.S. Boltovets, R.V. Konakova, Ya.Ya. Kudryk, S.V. Novitskii, V.N. Sheremet, J. Li, S.A. Vitusevich. Mechanism of contact resistance formation in ohmic contacts with high dislocation density. J. Appl. Phys. - 2012. - 111. - 083701.