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MODIFICATION OF OHMIC CONTACTS TO N-INN BY RAPID THERMAL ANNEALING

Among the new semiconductor materials nitrides have a special place due to the number of physical parameters. Indium nitride – a direct semiconductor of III-nitrides group which has band gap (~ 0.7 eV), low effective mass, high value of saturation velocity and high electron mobility [1], that makes it a promising material for high-speed semiconductor devices. There are terahertz emitters, detectors and highly efficient solar cells. Creating low resistance highly reliable, thermally stable ohmic contacts to the semiconductor is one of the major challenges to the development of semiconductor devices based on InN.

In this article we investigated the structure of Au(100 nm)-Ti(50 nm)-Pd(30 nm)-n-InN(2,5 μm)/GaN(0,9 μm)/Al_2O_3 with concentration of donors ~$8.3\cdot10^{18}$ in n-InN films. Measurement of the contact resistivity (ρ_c) of data samples was conducted by the Circular Transmission Line Method (CTLM). The resulted value ρ_c at room temperature was $\rho_c=5\cdot10^{-5}$ ohm·cm^2. To improve the contact between the metallization and semiconductor rapid thermal annealing was used at temperature of 350^0 C for 2 min. As a result, the contact resistivity decreased by 6 times to $\rho_c = 5\cdot10^{-5}$ ohm·cm^2, and the observed reduction of dispersion of contact resistivity on the lamel. Additional annealing at temperature of 370^0 C for 2 minutes led to a further reduction of the contact resistivity to $\rho_c=3{,}2\cdot10^{-5}$ ohm·cm^2, and the reduction of dispersion more than three times compared with initial samples (at 68.7%). Since the parameters of the obtained ohmic contact are close to the theoretically calculated limit, for the contact formed temperature dependence ρ_c was measured to determine mechanism of current transfer in it. Usually mechanisms of current transfer presume downward temperature dependence or it is absence. However, dependence ρ_c (T) obtained in this study is characteristic of metals, in particular ρ_c increases were observed with temperature rise. It can be described by a novel concept explaining the unusual behavior of ohmic contacts in the model considering the current flow through the metal shunts along the dislocations and current limitation by a diffusion mechanism supplying electrons [2-4]. However, the final determination demands further research.

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LITERATURE

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