# THE COMPLEX OF NEUTRON TRANSMUTATION DOPING OF SILICON ON THE BASIN TYPE REACTOR LIKE IRT

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The modern industry is impossible without the use of radiation technology products. Especially, it can be seen when a creating of new power electronics devices that are based on a neutron-doped (NTD) silicon. NTD technology, among all the existing methods for doping silicon, provides the highest uniformity of electrophysical parameters of semiconductors. Therefore NTD silicon is widely used in the world in order to create devices with minimal scatter of electrical resistivity: thyristors, charge coupled devices, VLSI, radiation detectors, photodetectors [1]. The principal difference silicon doped with neutrons from conventional methods is the dopant – phosphorus is not input into the starting material from outside, and it is formed during the irradiation of the atoms directly doped material:

$$^{30}\mathrm{Si}(n,\gamma)^{31}\mathrm{Si}\xrightarrow{\beta^-}{}^{31}\mathrm{P} \quad (1)$$

With the help of this implantation method, there are opportunities to control the dopant concentration. Moreover, one of the major advantages of this method of phosphorus input in silicon is a good repeatability of doping and obtaining desired materials. [2, 3]

On the reactor IR*T*-T in 1986 the facility for NTD silicon ingots with diameter up to 4 inch with world-class quality was put in place. However, currently a growing demand in the electronics industry on NTD silicon wafers diameter of 5 inches and above. In this regard, researches of the parameters of the neutron fields of HEC-4 of IR*T*-T was conducted in order to clarify the possibility of creating a new facility with a higher productivity for NTD silicon ingots up to 5 inches.

The result of researches is a theoretical model of the silicon ingots motion in the irradiation zone was developed. The implementation of this model was carried out on a horizontal experimental channel HEC -4 IR*T*-T. Automated facility was created for the irradiation of silicon ingots with length up to 700 mm and diameter up to 130 mm. The spatial inhomogeneity of doping does not exceed 5 %. The productivity of the facility for silicon ingots with a diameter of 5 inches and nominal electrical resistivity of 60 ohm·cm is equal 2 kg / h. The quality of NTD silicon is not inferior to the world standards.

1. Nuclear Technology Abroad. 2008. Issue 4.
2. Solid State Physics. 1999. V.41. Issue 5.
3. V.A.Varlachev *at al.* //Atomic energy. 1995. V.79. Issue 1. P.38.