Nanostructured surfaces

Ion beam synthesis of SiC nanostructures in Si

O. Oberemok*, T. Sabov, V. Melnik, B. Romanyuk, V. Popov

NAS of Ukraine, V.E. Lashkaryov Institute of Semiconductor Physics, 41, pr. Nauki, Kyiv, 03028, Ukraine.
**E-mail: ober@isp.kiev.ua*

Nanostructured wide-bandgap SiC semiconductor is perspective material for creation of different sensors, opto- and high frequency electronic devices. It can be operated in extreme conditions of temperature, power and radiation. One of the methods to fabricate such structures is the high dose ion beam implantation of the carbon in the silicon matrix [1]. The advantages of precise and predictable control of energy and dose of the implanted C ions allow controlling the depth, stoichiometric composition and thickness of the buried layer. SiC phase formation usually is carried out during the post implantation thermal annealing. Wide Gaussian distribution of the implanted carbon on the depth allows investigating the SiC nanostructure formation at the different concentrations of C and Si [2].

Si samples (n-type, <100>) were implanted by C^+ ions with energy 120 keV and dose 5×10^{17} cm^{-2}. The furnace (1 hour) and rapid thermal annealing of samples were carried out at 1250^oC in the argon ambient. Depth profiles of the implanted dopant were measured by SIMS method. The annealing does not significantly change the C depth profile. Raman and Photoluminescence (PL) spectra of created structure were measured after the plasma ion etching of the surface Si film. After annealing there are fixed the PL bands in 400 and 800 nm regions that is an evidence of the SiC and Si nanoclusters existence. Detailed FTIR spectroscopy analysis and XRD studies confirm the formation of SiC phase. The grain size of the SiC precipitates is a few nanometers. It is confirmed by the TEM and AFM data.

In this work, the spectroscopic characterization of high-dose carbon-ion-implanted silicon samples has been performed on the different depths. The obtained results are discussed within the framework of the model of stimulated creation of the C-enriched buried layer.

1. *Klyui N., Kruger D., Romanjuk B., Litovchenko V., Richter H.* SiC buried layer formation induced by ion implantation // Solid State Phenom. -1996. **-47 &48. -**P. 211-216.
2. *Litovchenko V., Romanyuk B., Melnik V., Kladko V., Popov V., Oberemok O., Khatsevich I.* Stimulated Creation of the SOI Structures with Si nano-clusters by low-dose SIMOX Technology // Solid State Phenom.-2011.**-178-179**, -P. 17-24.