

Germanium Nanowires Layer Formed by Ion Implantation and Incoherent-Light Pulse Annealing

Farrakhov Bulat F.,^{1*} Stepanov Andrei L.,² Fattakhov Yakhya V.,¹
Konovalov Dmitry A.,² Nuzhdin Vladimir I.,² Valeev Valery F.²

¹ Laboratory of medical physics, Zavoisky Physical-Technical Institute FCR Kazan Scientific Center of RAS, Sibirsky tract 10/7, 420029, Kazan, Russia

² Group of Nanooptics and Nanoplasmonics, Zavoisky Physical-Technical Institute FCR Kazan Scientific Center of RAS, Sibirsky tract 10/7, 420029, Kazan, Russia

*E-mail: bulat_f@mail.ru

The study addresses the monocrystalline c-Ge substrates implanted by Ag^+ ions with the energy of 30 keV, irradiation dose of 7.5×10^{16} ion/cm² and annealed by incoherent-light pulse. By scanning electron microscopy and optical spectroscopy measurements it was shown that after ion implantation an amorphous porous Ag:PGe layer of a spongy structure with nanowires on the c-Ge substrate were formed. The spongy pulse light annealed structure of the Ag:PGe layer was not destroyed, however the diameters of nanowires increased by about 1.5 times.

Monocrystalline c-Ge (100) n-type plates 150 mkm thick were selected as substrates [1]. The implanted Ag:PGe samples were annealed in air by ILP by special “Impuls-6” equipment with halogen lamps located in a sealed reaction chamber as heating elements. Annealing of implanted Ge was realized with 1 light pulse, duration 5 s. The power density of the light pulse was 30 W/cm². The surface sample temperature was measured to be near 600 °C.

The surface morphology of the Ag:PGe samples was studied using Merlin (Carl Zeiss) scanning electron microscope (SEM). Optical reflection spectra were measured by AvaSpec-2048 spectrometer (Avantes). Fig. 1 shows histograms of the nanowire.

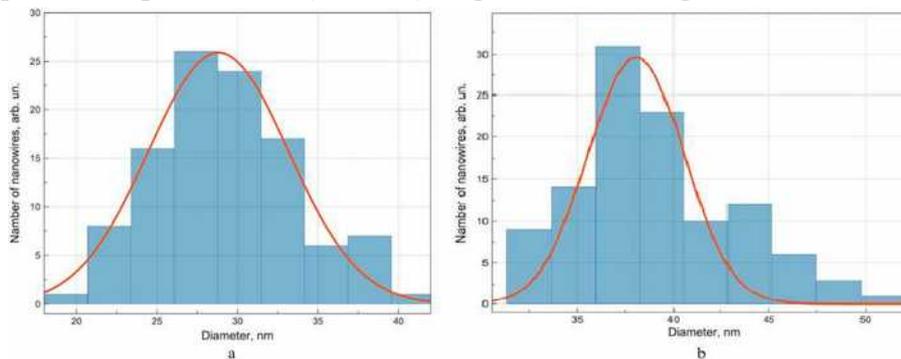


Fig. 1. Histograms of the nanowire diameters for the c-Ge implanted by Ag^+ ions at $E = 30$ keV, $J = 8$ mA/cm², $D = 7.5 \times 10^{16}$ ion/cm² and the same implanted sample treated by ILP annealing (b).

[1] A.L. Stepanov, B.F. Farrakhov, Ya.V. Fattakhov, et.al., *Vacuum* **2021**, *186*, p. 110060.