Invitation for Ph. D. Open Viva Voce Examination of Mr Ajay R. Yadav through Video Conferencing.
All are cordially invited.
Date: 26-05-2020 at 11.30 A.M

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Study of effects of silicon negative ion implantation in gallium arsenide compound semiconductor

Ion beam processing is a powerful and versatile technology used to synthesize and modify the materials. Generally positive ions are used in this process. However in positive ion implantation, the surface charging effect is quite large and gives trouble in the fabrication of charge sensitive devices. This problem can be overcome with negative ion implantation. The interesting phenomenon related to negative ion implantation is surface charging voltage, which is extremely low. In negative ion implantation, the incoming charge due to ion flux and the outgoing charge due to secondary electron are both negative, thus the charge balance takes place. The negative ion implantation has additional advantage of low electron affinity. In the present work, semi-insulating gallium arsenide samples were implanted with silicon negative ions with various fluences ranging between 1 x 10^{14} and 5 x 10^{17} ions cm $^{-2}$ at different energies. The effects of negative ions on structural, optical and electrical properties have been investigated using various anlytical techniques. The atomic force microscopic images obtained from samples implanted with different fluences showed the cluster formation on the surface of gallium arsenide. The shape, size and density of these clusters were found to be depend on the ion fluence.The energy dispersive X-ray analysis showed increase in the silicon concentration in gallium arsenide sample with respect to increasing ion fluence. The X-ray photoelectron spectra showed shift in Ga3d and As3d core levels towards higher binding energy side in the implanted sample with respect to un-implanted sample, which were indicative of the change in the chemical state environment of Ga–As bond. The UV-Vis- NIR spectra showed absorption band between 1.365 eV and 1.375 eV due to the formation of intersubband of SiGaAs for fluences ≥ 1x10^{15} ion cm^{-2}. Glancing incidence X- ray diffraction study revealed the formation of silicon crystallites in the gallium arsenide sample after implantation with silicon negative ion. The current-voltage measurements of the samples implanted with different fluences exhibited diode like behaviour.

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