Contribution ID: **894** Type: **Oral**

Intensive formation of K radiative centers in silicon nitride by implantation with carbon ions

Wednesday, 13 October 2021 17:00 (15 minutes)

The implantation of silicon nitride with carbon ions stimulates the formation of additional emitting centers, which are appearing growth points for silicon nanoclusters. Moreover, this method makes it possible to set the sizes of nanocrystals, change their concentration, as well as the properties of the "nanocluster - matrix" interface. All of the above makes photoluminescence controllable and increases its intensity[1,2].
Synthesis of silicon nitride thin film was carried out by PECVD method. The ratio of the reacting gases SiH*4*/N*2* was 1/3 and 1/6 for the SiN1.1 and SiN1.5 samples, respectively. The carbon implantation fluencies were 1 × 10^14 cm-2, 2 × 10^15 cm-2 and 1 × 10^16 cm-2 in experiment.
The spectrum of photoluminescence was detected in the minimum fluence (1 × 10^14 cm-2) and subsequent annealing at 1100 ℃ for one-hour samples. It noted that at this annealing temperature an additional band appears with a maximum at 450 nm. This indicates that at a given annealing temperature, the presence of carbon leads to additional centers of radiative recombination. To confirm this effect, the duration of annealing at 1100 ° C extended to four hours. At a given duration of annealing, a luminescence signal already appears for samples implanted with increased fluencies (2 × 10^15 cm-2 and 1 × 10^16 cm-2). For sample implanted fluence of 1 × 10^14 cm-2 and annealed for four hours at 1100 ℃, the luminescence spectrum is more intense and shifted to the short-wavelength region compare to sample with a similar annealing without pre-implantation. This confirms the participation of carbon atoms in the formation of radiative recombination centers at high annealing temperatures.

Acknowledgment
This research was funded the program № AP09562076 «Synthesis of Si3N4/SiO2/Si heterostructures and study of the properties of paramagnetic centers which are stable at the different annealing temperatures» by the Committee of Science of the Ministry of Education and Science of the Republic of Kazakhstan.

References

1. Mukherjee, J Bhowmik, D Mukherjee, M Satpati, B Karmakar, P Alternating silicon oxy-nitride and silicon oxide stripe formation by nitric oxide (NO+) ion implantation// Journal of applied physics.-2020.Vol.127., -P. 145302-1- 145302-10 https://doi.org/10.1063/1.5144960
2. Vlasukova, L Parkhomenko, I Komarov, F Akilbekov, A Murzalinov, D Mudryi, A Ryabikin, Y Romanov, I Giniyatova, S Luminescence of silicon nitride films implanted with nitrogen ions // Materials research express.-2018. Vol.5,№ 096414. P.1-10 http://dx.doi.org/10.1088/2053-1591/aad7a6

Primary author: Dr MURZALINOV, Danatbek (Institute of Physics and Technology, Satbayev University)

Co-authors: FEDOSIMOVA, Anastasia; Ms SHAIKENOVA, Aigul; Ms UMIRZAKOV, Arman; Dr DMITRIYEVA, Elena; Mr RAKYMETOV, Bagdat

Presenter: Dr MURZALINOV, Danatbek (Institute of Physics and Technology, Satbayev University)

Session Classification: Applied research

Track Classification: Applied Research