Ion beams have been used to nucleate embedded nanocrystals into different material matrix, such as using of N implantation into InP and N co-implantation into Si[1]. By other hand there has been a lot of interest in indium nitride materials due to their potential applications in optoelectronic devices. Indium nitride presents high mobility and high saturation velocity due to its low effective mass, which makes it applicable in high speed and high frequency electronic devices. It is shown in the literature that it is possible to operate indium nitride-based light emitting diodes at spectral wavelengths ranging from the near-infrared to the ultraviolet region of the electromagnetic spectrum.

Inspired in the importance of InN and the possibility to form nanocrystals into other material by ion implantation. In this work we present a shallow (low energy)/(high dose) ion implantation of In+ into pGaN to study the possibility to form nanocrystal nucleation and its effect in luminescence emission. The characterization was performed by SIMS, HXRD, Raman and Photoluminescence. SIMS was used to study implantation distribution and its redistribution by thermal treatment, since an out-diffusion was observed as thermal annealing increase causing a reduction of its atomic concentration form $2 \times 10^{21}$ to $5 \times 10^{20}$ cm$^{-3}$ for as implanted sample to annealed at 900°C respectively. Structural characterization by HRXD and Raman revels crystal recovery for high temperature as 900°C. From PL spectroscopy red shift was found for as implanted sample and the shift was decreased as annealing temperature increase. Furthermore an additional transition was observed around to 1.5 eV attributed to InN nanocrystals emission. In conclusion the ion implantation at low energies and high dose of In+ into GaN was studied by analytical techniques where interesting emission was observed attributed to quantum confinement due InN nanocrystal nucleation into GaN.

Keywords: In+, ion implantation, GaN

References:


Presenting author’s email: chernandez@fis.cinvestav.mx