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Pre-sputter Technology for GaN Acceptor Doping by Mg-ion Implantation

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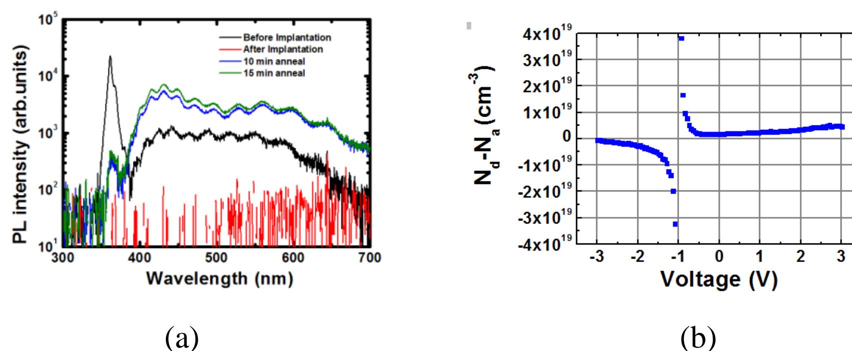
Ion implantation is a very promising technology for acceptor doping to GaN for it can control both vertically, by specifying the ion energy and dose, and laterally by using appropriate masking techniques. We propose pre-sputter technology for Mg-ion implantation process to reduce the implantation damage of GaN layer by sputtering an AlN layer before implantation process. AlN layer could easily cause the nuclear collision which remained more implantation damage outside of GaN layer. With the pre-sputter technology we could lower the implantation damage, get high surface ion concentration and also lower the contamination while HT-implantation process. By using sputtered AlN layer, it can more easier to control the thickness and easily taking off the sputtered layer only by wet etching with using developing fluid. And also, by depositing the cap AlN layer before implantation process, we could get a good contact between the cap layer and the sample surface which is very important for realizing high temperature post anneal to recover the implantation damage and activate the implanted ions.

In this experiment, we grew the u-GaN by MOVPE method and carried out Mg-ion implantation process. After the implantation, the post anneal, which was carried out in MOVPE chamber in ammonia and hydrogen gas environment at 1200℃ for 10 or 15 minutes, effectively recovered the optical property which was confirmed by PL measurement and also confirm negative N_d-N_a which was confirmed by C-V measurement.



(a)　　(b)

Fig.1. (a) PL spectrum of u-GaN before and after post anneal at 1200℃; (b) voltage and carried density relationship after Mg-ion implantation and 10min post anneal at 1200℃.

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