

## Detail Study on Lattice Deformation and Recovery of GaN by Mg-ion-implantation and the Subsequent Thermal Annealing

Zheng Sun<sup>3</sup>, Marc Olsson<sup>3</sup>, Di Lu<sup>3</sup>, Tsutomu Nagayama<sup>1</sup>, Tetsuya Watanabe<sup>2</sup>,

Yoshio Honda<sup>3</sup>, and Hiroshi Amano<sup>3,4</sup>

Nissin Ion Equipment Co., Ltd.<sup>1</sup>, Nissin Electric Co., Ltd.<sup>2</sup>,

Department of Electrical Engineering and Computer Science<sup>3</sup> and Akasaki Research Center<sup>4</sup>,

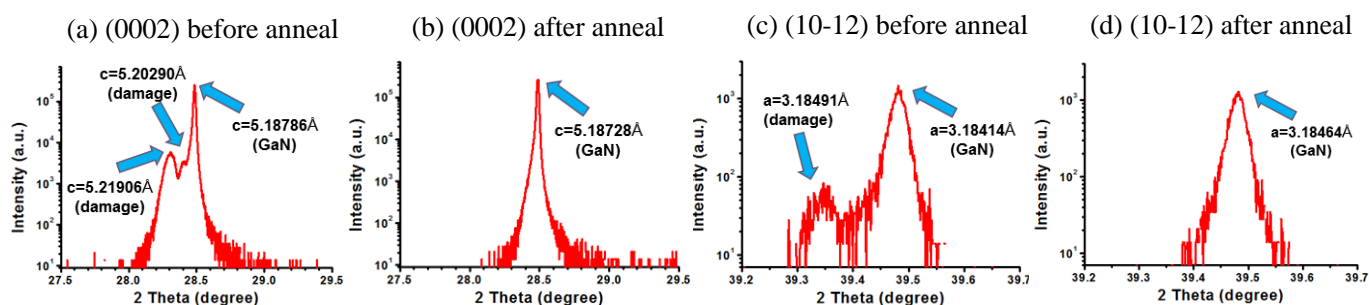
Nagoya Univ.

E-mail: s\_sun@nuee.nagoya-u.ac.jp

Application of ion-implantation technology to achieve p-type GaN remains a challenge. A significant obstacle is that the calculated anneal temperature (estimated around 1400-1500°C) is much higher than the growth temperature of GaN (around 1000°C). It is hard to recover the ion implantation damage and activate the implanted ions with GaN. After the Mg-ion-implantation, we confirmed change of lattice constant due to damage in the Mg implanted layer. To understand the implantation damage recovery, it is important to make a detailed study on lattice deformation and recovery of GaN by Mg ion implantation and the subsequent thermal annealing.

In this experiment, we grew u-GaN by MOVPE method and carried out the Mg-ion-implantation. We also carried out the thermal annealing at 1150°C. The X-ray  $2\theta - \omega$  on (0002) face and (10-12) face results were plotted in fig.1. A strong sub-peak indicated the formation of the damaged layer showing the different lattice constant. After the post annealing, the sub-peak disappeared indicating the recovery from ion-implantation damage.

**Acknowledge:** This work was partly supported by Japan Science and Technology Agency, “Super Cluster Program”.



**Fig. 1.** XRD  $2\theta - \omega$  results on GaN after RT-single-implantation with PS-AlN<sup>1)</sup>.

1) Z. Sun, T. Nagayama, Y. Honda and H. Amano, “p-type GaN by Mg-ion Implantation with Pre-sputter Technique,” ISPlasma 2014 / IC-PLANT 2014, no.06aC04OLN, Nagoya, Japan, Mar. 2014.