

Chapter 5 Conclusions

5.1 Conclusions

We have studied the epitaxial growths and characterizations of Si doping GaN, GaN:Mg and In isoelectronic doped p-GaN films grown by metalorganic vapor phase epitaxy technique systematically.

5.2 In isoelectronic doping GaN:Mg

We have studied the isoelectronic In-doping effects on Mg-doped GaN films grown by MOCVD. The preliminary results indicate that when In atoms are added, the surface morphology is greatly improved, and a virtually featureless structure can be obtained, particularly for films grown at high Mg flow rates. Furthermore, comparatively good Hall properties are also displayed in these films. The resulting optimum hole concentration and resistivity are $9 \times 10^{17} \text{ cm}^{-3}$ and $1 \text{ } \Omega\text{-cm}$, respectively. Perhaps the most striking result is the observance of a linear I-V characteristic on the as-deposited sample, which indicates the good Hall properties associated with such types of film. All of the above findings suggest that isoelectrical In doping is a viable technique, and has potential for the preparation of high quality p-type GaN material.

We have showed the PL intensity of the 3.1 eV band in p-GaN was enhanced with In doping. It reduces the native defect by forming self-compensation centers and caused Mg_{Ga} concentrations increase. Our results also indicate an energy barrier of the shallow Mg acceptor state. The barrier energy of In-doped p-GaN ($103 \pm 7 \text{ meV}$) was

obtained that is higher than that of p-GaN (69 ± 8 meV).

