

HVPE growth of bulk GaN and Homoepitaxy for Device Applications

Ke Xu

¹*Suzhou Institute of Nano-tech and Nano-bionics, Chinese Academy of Sciences*

²*Suzhou Nanowin Science and Technology Co., Ltd.*

Address: Ruoshui Road 398, Suzhou Industry Park, Suzhou 215123, P. R. China

Growth technologies of bulk GaN substrate have been developed very fast, including Hydride Vapor Phase Epitaxial Growth (HVPE), Ammonothermal method, Na-flux method, due to its rapidly increased demands in fabrication of laser diodes, power electronic devices [1]. More than 6 inch GaN substrate grown by HVPE was also reported. However, the challenges in fabricating high-quality and low-cost bulk GaN substrate still exist, such as dislocation density reduction, n-type doping, semi-insulating substrate, bowing control, and surface preparation, etc. In this work, the recent progress in bulk GaN substrate growth by HVPE in our group are reported, including 4~6-inch bulk GaN growth, doping with Si, Ge and Fe. The bulk GaN by HVPE has dislocation density in 10^5cm^{-2} order, and background electron concentration in the order of 10^{16}cm^{-3} , and electron mobility of around $1300\text{V} \cdot \text{s}/\text{cm}^2$. Finally, we summarized the latest device progress on GaN substrate, including LED, laser diode, high electron mobility transistors, and other electron devices. We believe homoepitaxial growth technology will boost the next rapid growth of nitride semiconductor industry.