

Improvement of the optical properties of GaN epilayers on Si(111): Impact of GaAs layer thickness on Si and pre-growth strategy

Abstract

This paper reports the effect of the GaN coating layer on the optical properties of GaN epilayers grown on GaAs/Si(111). Almost crack free GaN epilayers are found to be grown when a thin (~25 nm) GaN coating layer is inserted on 0.5 and 2 μm GaAs layers at 550 $^{\circ}\text{C}$. Then nitridation of the GaAs layer is done through the coating layer by NH_3 flow while the substrate temperature is ramped at 1000 $^{\circ}\text{C}$ for epilayer growth. An attempt has also been made by implementing an additional GaN interlayer at 800 $^{\circ}\text{C}$ while growth is continued for epilayer growth. For this growth strategy, cracks also happened without improvement of the epilayer quality. PL measurements show high excitonic peak energy and high excitonic to yellow band intensity ratio for GaN epilayers grown on the 0.5 μm GaAs converted layer (CL) using a thin GaN coating layer. Those values are also found to be comparable/ better than for epilayers grown on 2 μm CL.