Direct Growth Of AlGaN nanorod LEDs on graphene-covered Si

High density of defects and stress owing to the lattice and thermal mismatch between nitride materials and heterogeneous substrates have always been important problems and limit the development of nitride materials. In this paper, AlGaN light-emitting diodes (LEDs) were grown directly on a single-layer graphene-covered Si (111) substrate by metal organic chemical vapor deposition (MOCVD) without a metal catalyst. The nanorods was nucleated by AlGaN nucleation islands with a 35% Al composition, and included n-AlGaN, 6 period of AlGaN multiple quantum wells (MQWs), and p-AlGaN. Scanning electron microscopy (SEM) and electron backscatter diffraction (EBSD) showed that the nanorods were vertically aligned and had an accordant orientation along the [0001] direction. The structure of AlGaN nanorod LEDs was investigated by scanning transmission electron microscopy (STEM). Raman measurements of graphene before and after MOCVD growth revealed the graphene could withstand the high temperature and ammonia atmosphere in MOCVD. Photoluminescence (PL) and cathodoluminescence (CL) characterized an emission at ~325 nm and demonstrated the low defects density in AlGaN nanorod LEDs.