The crystal growth and photoluminescence characteristics of InGaN nanowires

Yun-Mo Sung
Daejin University - Korea (south)

Abstract

GaN, a novel Ⅲ-Ⅴ semiconductor, has been numerously studied for the applications in photo detectors (PD), laser diodes (LD), and light emitting diodes (LED), etc. Very recently GaN nanowires have emerged as a high-tech material with superior properties compared to thin films due to its low dimensionality. Thus, various fundamental studies on GaN nanowires including crystal growth are highly needed for applications. In this study based upon vapor-liquid-solid (VLS) mechanism InGaN solid-solution nanowires were fabricated by chemical vapor deposition (CVD) and substrates of GaN/AlN/Si(111) were used to induce epitaxial growth of defect-free InGaN nanowires. Also, the composition of InGaN nanowires was successfully controlled by changing the temperature of each In and Ga source loaded in a CVD chamber. X-ray diffraction (XRD) analyses on the nanowires show formation of InGaN solid solution. The lattice parameter of the GaN nanowires was systematically changed with the compositional variation in the solid solution. Scanning electron microscopy (SEM) on the InGaN nanowires showed formation of straight nanowires with diameter of 20-90 nm. Transmission electron microscopy (TEM) analyses on the InGaN nanowires showed high crystallinity with negligible defect concentration. Photoluminescence (PL) analyses on the InGaN nanowires showed high-intensity emission at about 365 nm. Also, the PL emission wavelength was changed with the composition of InGaN solid-solution nanowires.