고효율 LED 제작을 위한 비,반극성 GaN의 성장 및 결함 분석

공보현, 김동찬, 김영이, 안철현, 배영숙, 우창호, 서동규, 남옥현[*], 유근호[*], 장종진[*]
성균관대학교 신소재공학부, [*]한국산업기술대학교 나노광공학과

Abstract : In this study, we presented comparative discrimination methods to identify various line and planar defects observed in nonpolar a-GaN epilayers on r-sapphire substrates. Unlike the case of conventional c-GaN, which is dominated by perfect threading dislocations, systematic identification of undistinguishable defects using transmission electron microscopy (TEM) is necessary to suppress the propagation of defects in nonpolar GaN epilayers. Cross-sectional TEM images near the [0001] zone axis revealed that perfect mixed and pure screw type dislocations are visible, while pure edge, partial dislocations, and basal stacking faults (BSFs) are not discernible. In tilted cross-sectional TEM images along the $[1\bar{2}10]$ zone axis, the dominant defects were BSFs and partial dislocations for the $g = 10\bar{1}0$ and 0002 two-beam images, respectively. From plan view TEM images taken along the $[11\bar{2}0]$ axis, it was found that the dominantpartial and perfect dislocations were Frank-Shockley with $b = \pm 1/6<20\bar{2}3>$ and mixed type without an l component including $b = \pm 1/3<1\bar{2}10>$ and $\pm 1/3<\bar{2}110>$, respectively. Prismatic stacking faults were observed as inclined line contrast near the [0001] zone axis and were visible as band contrast in the two-beam images along the $[1\bar{2}10]$ and $[11\bar{2}0]$ zone axes.

Key Words : Compound semiconductors, Nitrides, Transmission electron microscopy