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Microstructural Properties and Photoconductivity of GaN Nanorods Grown by Molecular Beam Epitaxy

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Vertical aligned GaN nanorods were successfully grown on Si substrate by molecular beam epitaxy (MBE) method. Spotty reflection high energy electron diffraction (RHEED) patterns were observed during the growth. The X-ray diffraction (XRD) analysis and the selected area electron diffraction (SAED) pattern showed the orientation relation of GaN $\langle 2\bar{1}\bar{1}0\rangle$ // Si $\langle 110\rangle$ and GaN {0001} // Si {111}. The GaN nanorods were free from any amorphous sheath layer and any other metal particle. Photoconduction phenomenon was observed in single crystal GaN nanorods. Individual GaN nanorod was fabricated to a single FET. The single nanorod FET showed distinctive response to two UV wavelengths of 365 and 254 nm. Very thin GaN nanorods, with below 20 nm in diameter, behaved like a insulating material. The dark current measured from the nanorod FET is inferred to be a background current not related to transport through the GaN nanorod. After illumination with UV light of 254 nm, slightly increased photocurrent was obviously observed. On the other hand, UV light of 365 nm hardly affected the photoconduction phenomenon. In addition, the single GaN nanorod FET exhibited the fast photoresponse speed, the reliability, and the reproducibility.