n-ZnO/*i*-ZnO/*p*-GaN:Mg 이종접합을 이용한 UV 발광 다이오드

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Ultraviolet LEDs using *n*-ZnO:Ga/*i*-ZnO/*p*-GaN:Mg heterojunction

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Abstract : ZnO has been extensively studied for optoelectronic applications such as blue and ultraviolet (UV) light emitters and detectors, because it has a wide band gap (3.37 eV) anda large exciton binding energy of ~60 meV over GaN (~26 meV). However, the fabrication of the light emitting devices using ZnO homojunctions is suffered from the lack of reproducibility of the *p*-type ZnO with high hall concentration and mobility. Thus, the ZnO-based *p-n* heterojunction light emitting diode (LED) using *p*-Si and *p*-GaN would be expected to exhibit stable device performance compared to the homojunction LED. The n-ZnO/p-GaN heterostructure is a good candidate for ZnO-based heterojunction LEDs because of their similar physicalproperties and the reproducibleavailability of *p*-type GaN. Especially, the reduced lattice mismatch (~1.8 %) and similar crystal structure result in the advantage of acquiring high performance LED devices with low defect density. However, the electroluminescence (EL) of the device using *n*-ZnO/*p*-GaN heterojunctions shows the blue and greenish emissions, which are attributed to the emission from the *p*-GaN and deep-level defects.

In this work, the *n*-ZnO:Ga/*p*-GaN:Mg heterojunction light emitting diodes (LEDs) were fabricated at different growth temperatures and carrier concentrations in the *n*-type region. The effects of the growth temperature and carrier concentration on the electrical and emission properties were investigated. The I-V and the EL resultsshowed that the device performance of the heterostructure LEDs, such as turn-on voltage and true ultraviolet emission, developed through the insertion of a thin intrinsic layer between *n*-ZnO:Ga and *p*-GaN:Mg. This observation was attributed to a lowering of the energy barriers for the supply of electrons and holes into intrinsic ZnO, and recombination in the intrinsic ZnO with the absence of deep level emission.

Key Words : LDE, UV, Sputtering, ZnO, GaN