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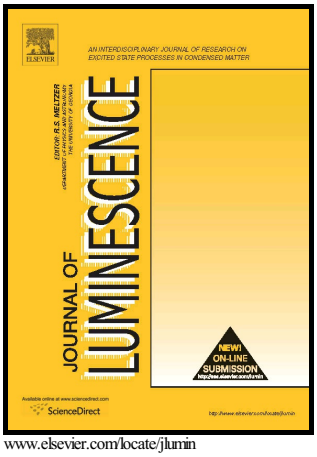

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Tailoring of electroluminescence from n-ZnO/p-GaN heterojunctions

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Abstract

In this study, electroluminescence (EL) from n-ZnO/p-GaN heterojunctions is investigated and tailored. The heterojunctions were obtained by depositing high-quality ZnO films on the p-GaN subtrate through pulsed laser deposition (PLD), and the characteristics were analyzed by X-ray diffraction (XRD), photoluminescence (PL) spectra at room-temperature (RT, 300 K), current-voltage (I-V) characteristics curves, and the EL spectra. By means of the band energy theory, a simple and effective way to tailor the luminescent properties of the heterojunction was discussed. The ultra-violet (UV) emission from the n-ZnO was obtained through the improvement of the electrical properties of the films and the substrates. The visible light emissions were tailored through the transition of different defect caused color emissions. Besides, an unexpected yellow light (YL) emission caused by Ga-O interlayer was also studied.

Keywords

n-ZnO/p-GaN heterojunctions, electroluminescence, photoluminescence, interface/ interfacial layer, UV emission, visible light emission

1. Introduction

The optical material ZnO has been intensively investigated due to its excellent optoelectronic properties, such as a direct wide band gap ($E_g = 3.37$ eV at 300 K), and a large exciton binding energy (~ 60 meV) which ensures an intense near-band-edge excitonic emission at room and higher temperature, since this value is 2.4 times of the room-temperature (RT) thermal energy ($k_BT = 25$ meV) [1]. ZnO also has high-radiation stability to wet chemical etching [2], and is very resistant to high-energy radiation [3] which makes it suitable for space applications. Etching easily in all acids and alkalis makes it possible for fabrication of small devices [1]. High