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Comparative study of the ZnO and Zn1−xCdxO nanorod emitters hydrothermally synthesized and electrodeposited on p-GaN

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Abstract

Hydrothermal synthesis and electrodeposition are low-temperature and cost-effective growth techniques of high quality nanostructured active materials for opto-electronic devices. Here we report a hydrothermal seed layer-free and rapid synthesis (15 min) of epitaxial nanorod arrays of ZnO on *p*-GaN(0 0 0 1). The effects of hydrothermal (HT) versus electrochemical deposition (ECD) synthesis on the optical properties of ZnO nanorods/nanowires on *p*-GaN substrate are compared in details. For both types of layers, a strong photoluminescent UV-emission was found indicating the high quality of the synthesized ZnO layer. The hetero-structures were used for LED applications. With HT-ZnO and ECD-ZnO, UV-emission started at remarkably low forward voltage of 3.9–4.0 V and 4.4 V respectively and increased rapidly. Moreover, the LED structures showed a stable and repeatable electroluminescence. We propose for further studies a simple, efficient, seed layer-free and low temperature hydrothermal growth technique to fabricate high quality ZnO nanorods/*p*-GaN heterojunction LED nanodevices. It is also demonstrated that a single short wavelength emission can be shifted to the violet range with Cd-alloying of ZnO used for LED structure.