

Enhancement with High Oxygen Pressure of ZnO Deep-UV Light Emitters with AlN Server Layer

Songül Fiat Varol¹, Ziya Merdan², Panagiota Koralli^{3,4}, and Michael Kompitsas⁴

1 Giresun University, Faculty of Engineering, Energy Systems Engineering, 28200, Giresun, Turkey

2 Gazi University, Faculty of Arts and Sciences, Physics Department, 06500 Ankara, Turkey

3 School of Mechanical Eng., National Tech. University of Athens, 9, Polytechniou, Zografos, 15780 Athens, Greece

4 National Hellenic Research Foundation, Theoretical and Physical Chemistry Institute, 11635 Athens, Greece

We reported color-saturated, ultraviolet (UV) light-emitting device (LED) using high quality deposition techniques such as Metal Organic Chemical Vapor Deposition (MOCVD) and Pulsed Laser Deposition PLD. The production of pure and high quality ZnO nano-size films is of the utmost importance for ZnO based deep UV light-emitting-diode (LED) applications. A combined experimental and characterization study of ZnO/AlN (IL)/GaN/AlN(SL)/Al₂O₃ is presented. AlN server layer (SL) (~300 nm), GaN and AlN interlayer (IL) (~20 nm) films were grown with MOCVD and ZnO films were grown by Pulsed Laser Deposition (PLD) system under different oxygen pressures (10-50 Pa). The heterojunction optical, electrical and morphological properties were examined. In the devices, the nano size films act as the light emitters. At room temperature, n-type ZnO LEDs exhibit low-threshold emission voltage between ~5-7 V and electroluminescence ultraviolet emission synchronized with PL results. The device show excellent optical characteristics at room temperature, such as stimulated emission. As one of the examples for device applications, LEDs that emit strong electroluminescence emission with increasing oxygen pressure as if it is a curing process by suppressing the all defects in luminesces.