Characteristic Enrichment of the Blue LED by MOCVD on Patterned Sapphire (0 0 0 1) Substrate

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Blue light-emitting diodes (LEDs) with an InGaN multi-quantum well (MQW) structure were fabricated on a patterned sapphire substrate (PSS) using a single growth process of metal organic chemical vapor deposition (MOCVD). The electrical and optical properties of these LEDs were investigated. The crystal quality of epitaxial GaN film was improved by using the PSS structure. At 20 mA injection current, the peak wavelength and the full-width at half-maximum of the electroluminescence spectra of PSS were 451 nm and 22 nm, respectively. The MQW optical power and operating voltage measured was about 5.1 V and 4.65 mW, respectively. The external quantum efficiency (EQE) was recorded at 39.3%. This significant increase resulted from the improvement of the epitaxial quality of the InGaN/GaN epilayers and the improvement of the light extraction efficiency through patterned sapphire substrates.