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High Brightness (HB) Blue/Near ZnO/Si Heterojunction Light Emitting Diode with Different Dopants

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In this study, we fabricated a p–n heterojunction ZnO LED by sol-gel chemical method with different Al dopant amounts, Here in this work, we demonstrated the capability of controlling the spatial distribution of the blue/near-UV LEDs composed of position controlled arrays of n-ZnO nanocrystals on a p-Si thin film substrate. The device was fabricated by Pulsed Laser Deposition with two laser ablations.

Control over the size, shape, surface roughness, and crystallization is of great significance for the fabrication of ZnO materials since they affect their performance in practical applications. Due to this, ZnO has been introduced into conventional Si-based LEDs to enhance the light extraction efficiency (LEE). It was found that ZnO submicrorods with needle-like or flat end modified LEDs possess much higher LEE.

The ZnO films were obtained with different Al ratios and evaluated as pure films and as Al doped films with different amounts. It was found that the device performance is strongly dependent on the dopant ratio.

The physical origin of this electroluminescence (EL) has been extensively studied and emission spectrum of the as-fabricated LED was monitored at different biased voltages/injection-currents at room temperature. We saw that, from 4 V to 10 V, the contour of the EL spectrum does not change much with the biased voltage. The dominant emission peak is slightly blue shifted in the range of 400 nm–420 nm with a full width at half maximum (FWHM) of about 70 nm.

Keywords: ZnO; Si; Pulsed Laser Deposition; Sol-Gel; Light Emitting, PL; EL