Supporting Information

Vertically-aligned ZnO microrod for high-brightness light source

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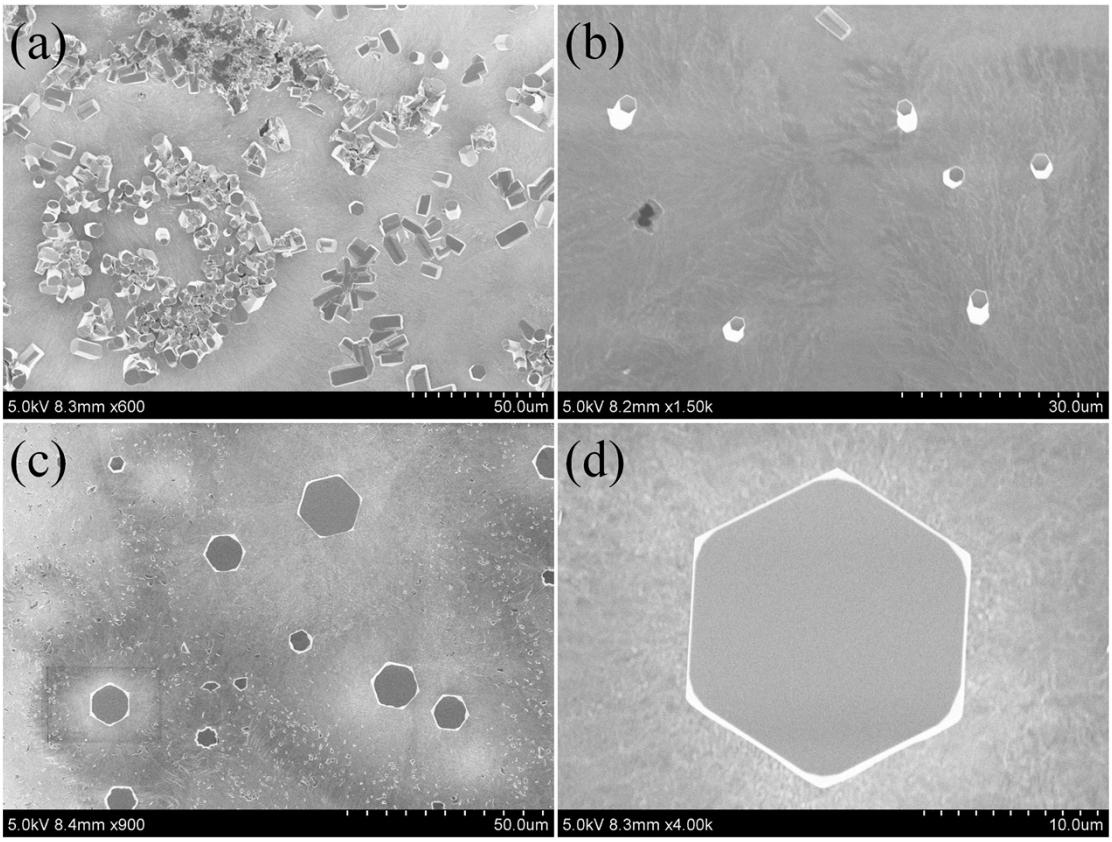

Figure S1. (a) SEM image of as-synthesized ZnO microrods, which deposited on the p-GaN substrate. (b)-(c) SEM image of as-synthesized ZnO microrods with low-density distribution. (d) Enlarged SEM image of a vertical-type ZnO microrod, illustrating perfect hexagonal cross-section.

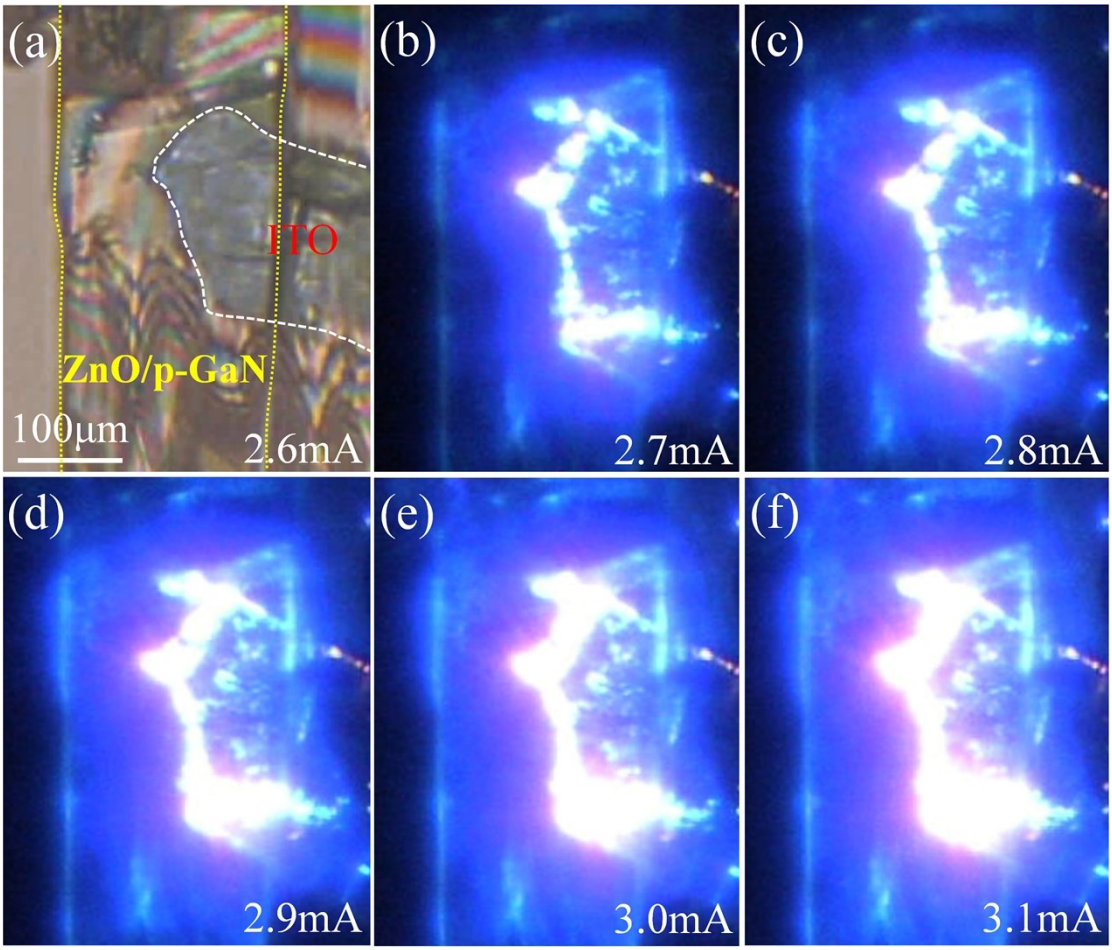

Figure S2. Top-view microscopic images of the blue-ultraviolet light-emitting from electrically biased heterojunction LED of vertically aligned n-ZnO microrods/p-GaN: (a) Optical photograph of heterojunction diode composed of vertically aligned ZnO microrod array grown on p-GaN template. As the injection current increased, optical microscopic images of bright blue- ultraviolet emissions were captured. The lighting became brighter with the increase of the injection current.

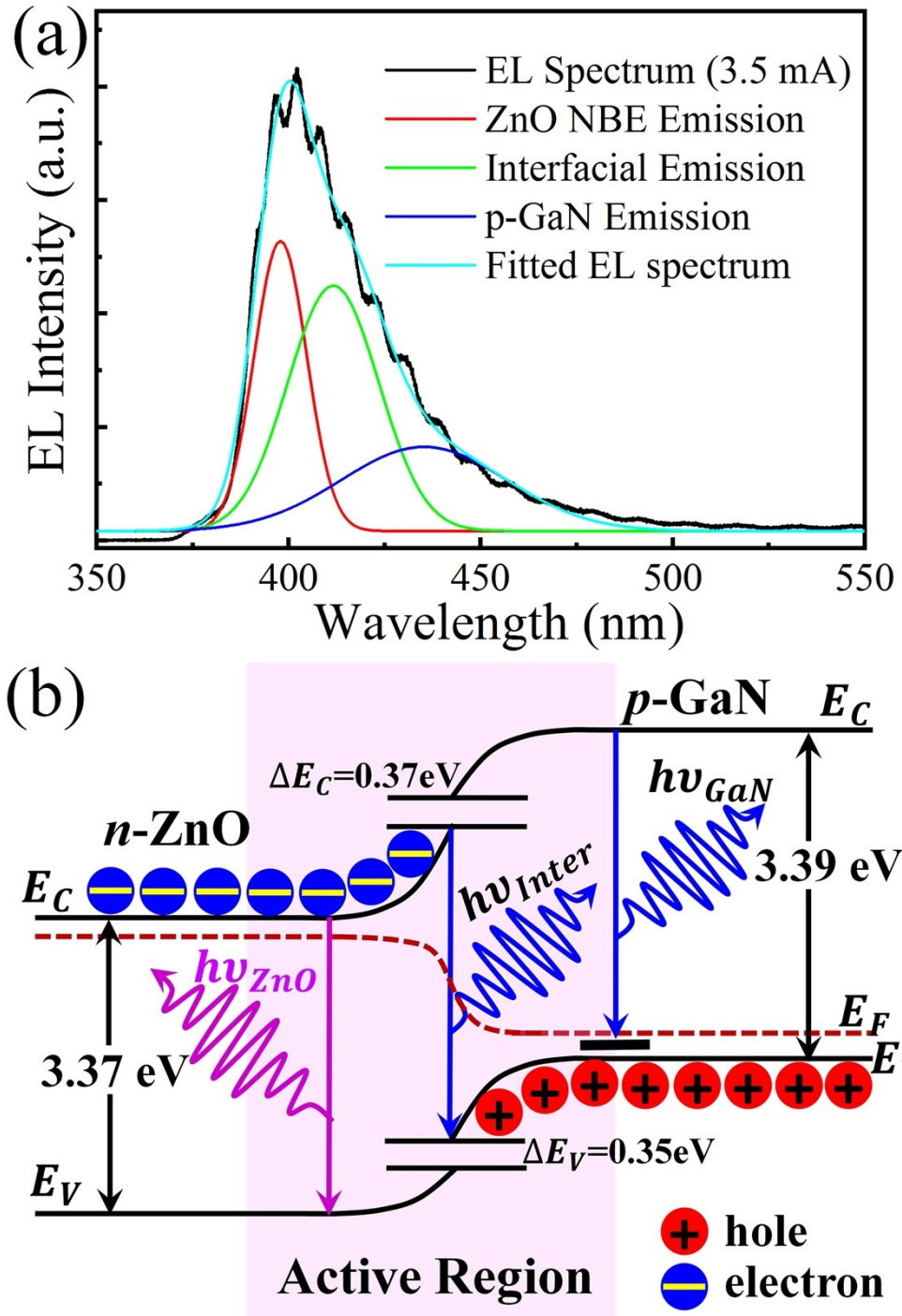

Figure S3. (a) The EL spectrum was decomposed into three distinct bands via Gaussian deconvolution analysis, which correspond to three different optoelectronic processes. (b) The schematic diagram of band diagram of the vertically aligned n-ZnO/p-GaN heterojunction under large biased voltage, where the three emission bands consisting of the near-ultraviolet emission are specifically illustrated.

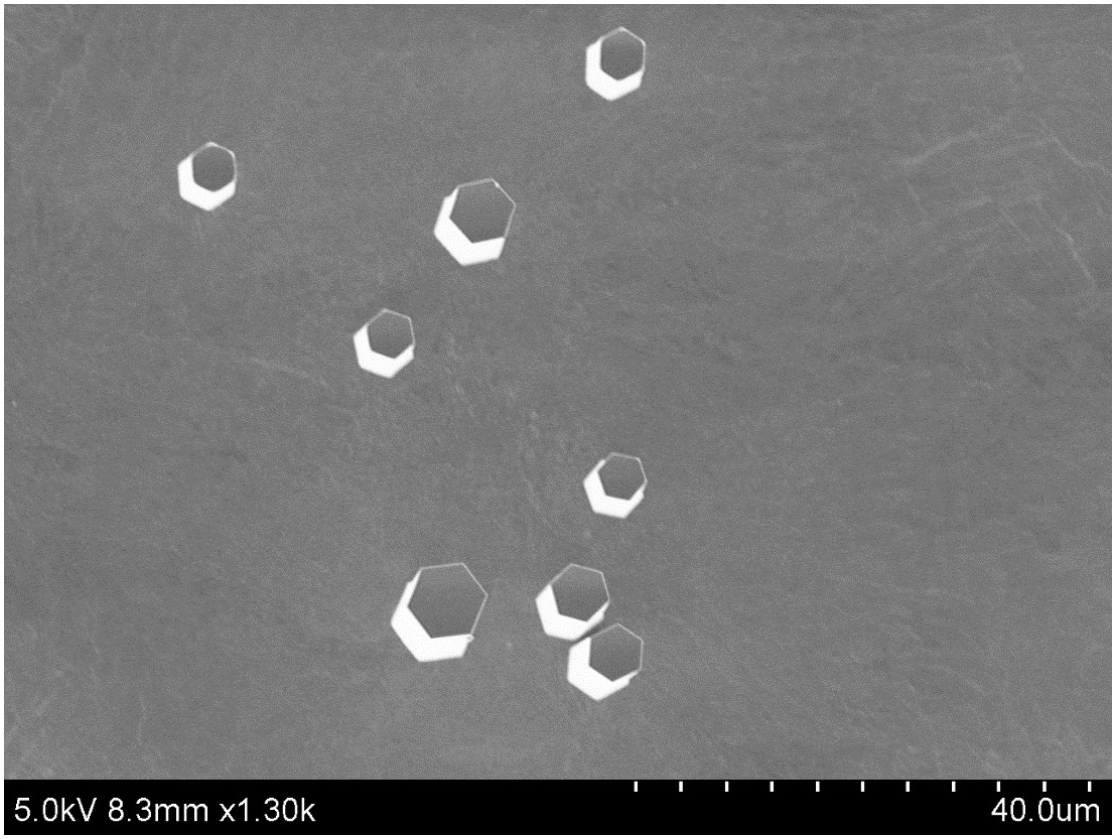

Figure S4. Large scale top view SEM image of the vertically aligned ZnO microrods, which prepared on p-GaN substrate.

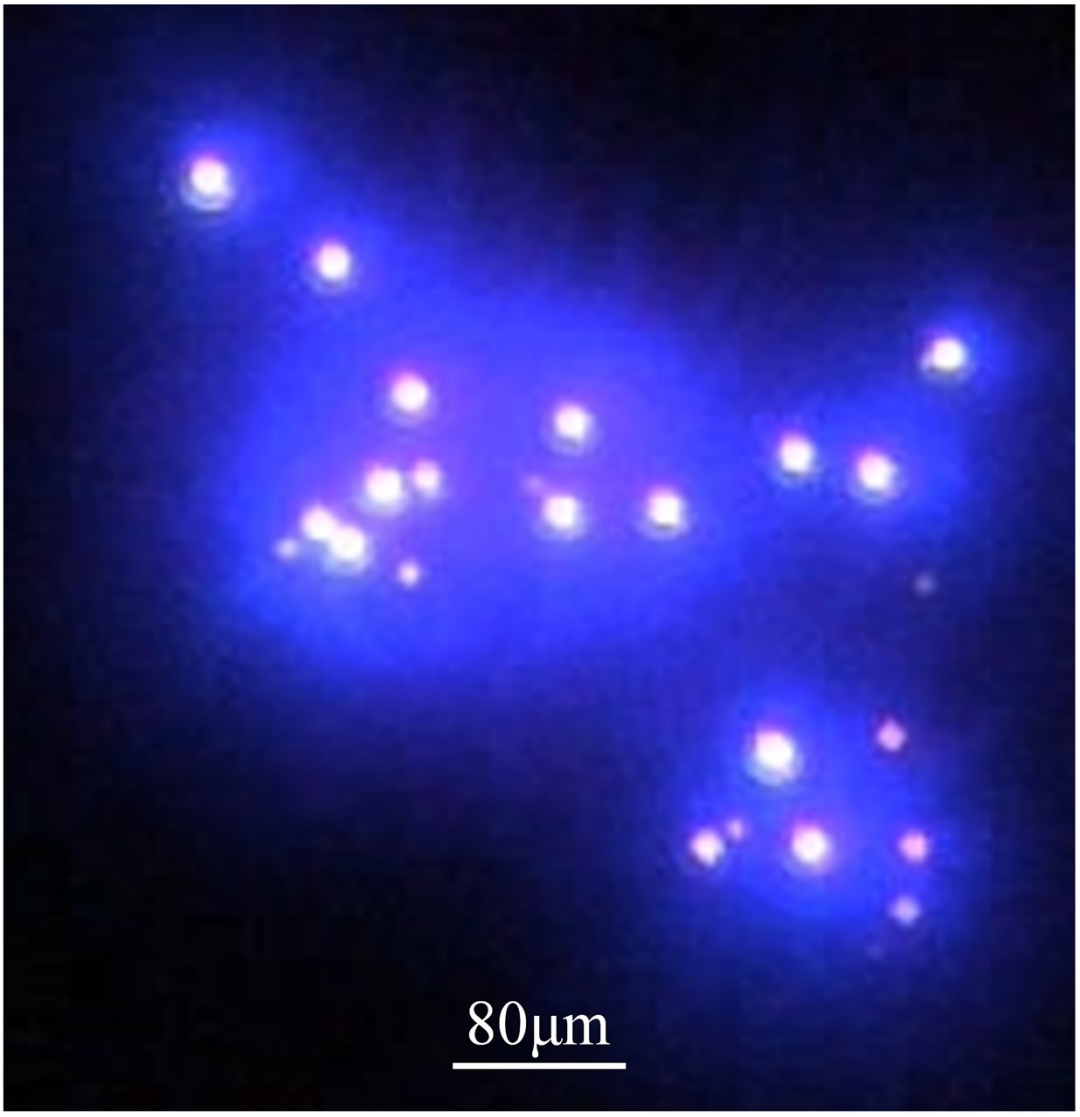

Figure S5. The microscopic EL image of the vertically aligned n-ZnO microrods/p-GaN LED at forward bias.

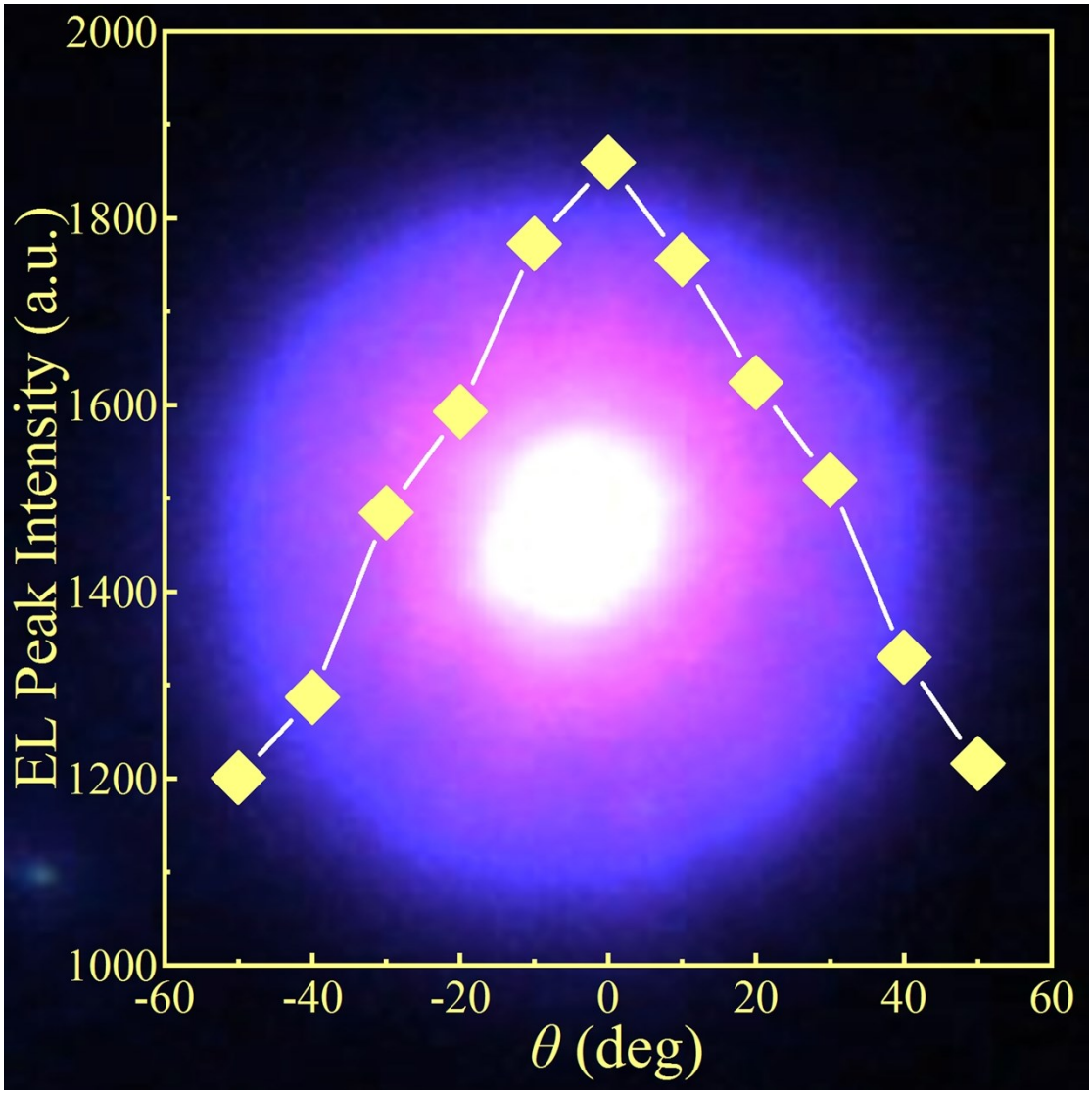

Figure S6. EL emission measurements was performed by rotating the device with respect to the axial direction of vertical single ZnO microrod. The angle distribution of the far-field emission patterns was depicted, the x-axis represents the emission angle θ with respect to the vertical growth direction and the y-axis represented the EL emission intensity.