UV Light Emitter on Bulk Semipolar (11-22) GaN

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Abstract: A 392 nm GaInN-based UV light emitter has been demonstrated by homoepitaxial growth technique aiming to improve quantum efficiency by crystalline perfection of the heterostructures on naturally stable semipolar (11-22) bulk GaN.

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1. Introduction

In order to improve quantum efficiency in a group III nitride based light emitter, an epixtial growth of non-polar and semipolar planes has been proposed[1]. The growth of these non *c*-axis emitters demonstrates an excellent device performance in visible light range (400 – 590 nm) when a low defect GaN substrate can be prepared by slicing of particular planes from a *c*-axis grown GaN bulk sample [2-5].

Here we are demonstrating superior performance also for a UV emitter with emission wavelength between 380 – 400 nm by the growth on naturally stable semipolar (11-22) planes.

2. Experiment and Results

A separate confinement device structure has been deployed for the growth on semipolar (11-22) substrate consisting of 3 pairs of 3 nm GaInN quantum wells and 12 nm GaN barriers sandwiched between n- and p-GaN (100 nm)/AlGaN (500-600 nm). A typical electron blocking layer of Mg-doped AlGaN is introduced on top of the last GaN barrier. As shown in Fig. 1(a), semipolar UV LED emitting at 392 nm produces approximately 40% and 10 % higher light output power (LOP) when compared to that of 394 and 409 nm *c*-plane LEDs, respectively. At high injection current density above 20A/cm^2, the semipolar LED exhibits much better performance than its *c*-plane counterpart. Usually, the efficiency of *c*-plane LEDs decreases rapidly when the peak emission wavelength is shifted from 409 nm to 394 nm. In the case of our semipolar LED, however, high current performance at the level of the 409 nm *c*-plane LED is obtained.

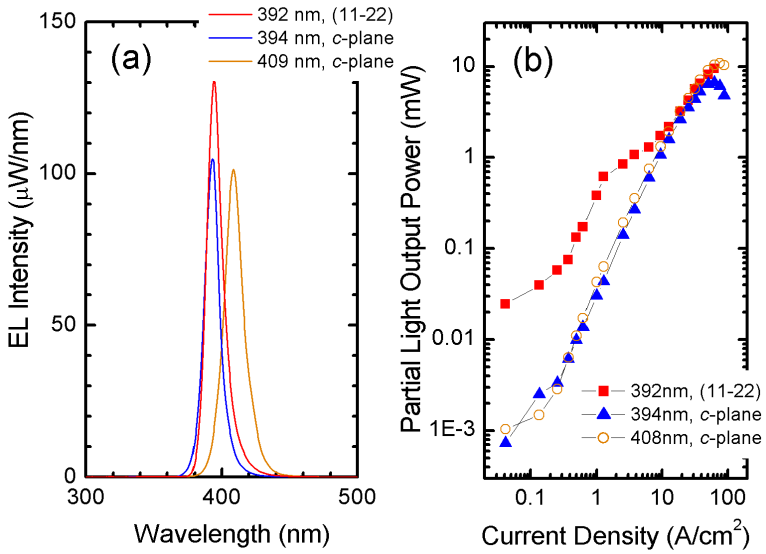

Fig. 1 Comparison of electroluminescence (EL) spectra at 12 A/cm^2 (a) and the corresponding light output power as a function of injection current density (b)

3. Conclusions

We demonstrate an improved performance of 392nm UV LED by utilizing an epitaxial growth on (11-22) bulk GaN. LOP increases by 40% when compared to that of *c*-plane one.

4. References

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