

High-efficiency GaN-based photonic crystal blue light-emitting diodes

S. K. Kim, H. K. Cho, J. Jang, J. J. Lee, and *Y. H. Lee

LED R&D Lab., LG Electronics Institute of Technology, Seoul 137-724, Korea

*Department of Physics, KAIST, Taejeon 305-701, Korea

The photonic nanostructure has been employed aggressively in various types of LEDs [1, 2]. Because all practical LEDs are covered with a certain capping material, it makes more sense to evaluate the LED output after encapsulation. In this paper, we studied the light extraction from photonic crystal (PhC) lateral-type GaN-LEDs before and after encapsulation. The square-lattice PhC arrays ($a=1200\text{nm}$) were defined into the top GaN surface by UV photolithography [Fig. 1(a)]. After (before) encapsulating with dome-shaped *Si*-gel, the integration sphere showed the relative enhancement of $\sim 35\%$ ($\sim 70\%$) in comparison with a conventional LED [Fig. 1(b)].

[1] Y. J. Lee, S. H. Kim, J. Huh, G. H. Kim, Y. H. Lee, S. H. Cho, Y.C. Kim, and Y. R. Do, *Appl. Phys. Lett.* 82, 3779 (2004)

[2] T. Fujii, Y. Gao, R. Sharma, E. L. Hu, S. P. Denbaars, and S. Nakamura, *Appl. Phys. Lett.* 84, 855 (2005)

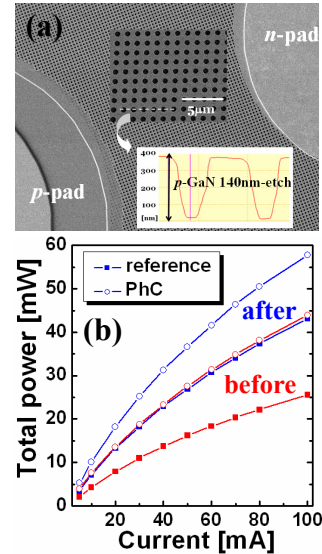


Fig. 1 (a) Top-view SEM image of the PhC GaN-LED ($a=1200\text{nm}$) (b) The $L-I$ curve of a reference (filled square) and the PhC LED (unfilled circle) before and after encapsulation