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# Improved performance GaN on GaN based LED with novel step of roughnening on backside (N-face) of GaN substrate

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***Abstract***

Homoepitaxial growth of GaN based LEDs on bulk GaN substrate is the way forward for the ultimate LED technology [1]. At this point, such LEDs still exhibit low light extraction efficiency, which subsequently degrades the overall performance of the LEDs. To overcome this, roughening the backside (N-face) of the GaN substrate after the LED growth; e.g [2] has been widely practised in many experiments. In this work, we go into opposite direction by roughening the N-face of the GaN substrate prior to the LED growth. It was found that the peak of external quantum efficiency (EQE) and optical output power of the LED on pre-roughened GaN substrate is 21.6% at 12 mA/cm2 while the LED on post-roughened GaN substrate is 20.6% at 14 mA/cm2 . The pre-roughnening removed oxides and carbon impurities on the Ga-face of the substrate. Hence, the LED was grown on a clean surface (Ga-face) of GaN substrate and hence, improving its performance. This is unlikely for the LED grown on the post-roughened substrate. Furthermore, in comparison to the post-roughnening, the pre-roughening does not require the additional step for coating on the p-GaN surface of LED component which is used in structure.

*Biography*

Ezzah Alias received her B.Sc degree (in 2012) and MSc degree (in 2015) from Universiti Sains Malaysia (USM). She is currently pursuing her PhD study at USM. As of now, Ezzah Alias has published 10 papers and has presented her work at more than 5 conferences. For her PhD project, she is working on developing nitrides based green LED on GaN substrate through MOCVD epitaxy. On top of that, Ezzah Alias is one of the key researchers for National Epitaxy Program of Malaysia, of which this program involves a strong partnership with prominent LED experts from University of California, Santa Barbara, USA

*Speaker Publications :*

1. Paskova, T., et at., Proceedings of the IEEE, 2010. 98(7): p. 1324. 2. Lin, C.-F., et al., Appl. Phys. Lett., 2009. 95(20): p. 201102.

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