The effect of TMAH treatment to designed green-micro LED

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Gallium Nitride (GaN)-based micro-LEDs (μLED) have been regarded as a promising candidate because of several advantages such as high brightness, power consumption, lift time, response time, operating temperature. In addition, the controllable size of μLED allows to realize a high-resolution display for virtual reality and augment reality. LED-based on GaN material has high-performance, however, the sidewall damage caused by plasma-based dry etching is a serious problem in μLED as LED size reduces to a few microns. To overcome the sidewall damage, potassium hydroxide (KOH) treated μLED has been reported.[1] However, KOH attacks m-plane GaN surface and unintended surface occurs which may cause deterioration of device properties.[2] Tetramethylammonium hydroxide (TMAH) having OH- same as KOH can lead to a stable etching process of GaN due to precise control of OH^- and $(CH_3)_4N^+$.[3]

Here, we report the effect of TMAH on μLED. We designed 50*50 μm^2, 70*70 μm^2 size LED structure that has a p-contact metal pad of 12*40 μm^2, and 32*60 μm^2 then compare samples with and without TMAH treatment. The mesa was made by ICP process based on Cl_2 gas followed by a sample that was soaked by 25 wt% TMAH at 80 °C for 1hour. Contact metal pads of P and N-type were Ni/Au (20/200 nm) and Ti/Al/Ti/Au (20/100/30/200 nm), respectively. **Figure 1** shows the properties of μLED through I-V, leakage current, which values were improved with TMAH treatment. For more detail, we will report at the conference.

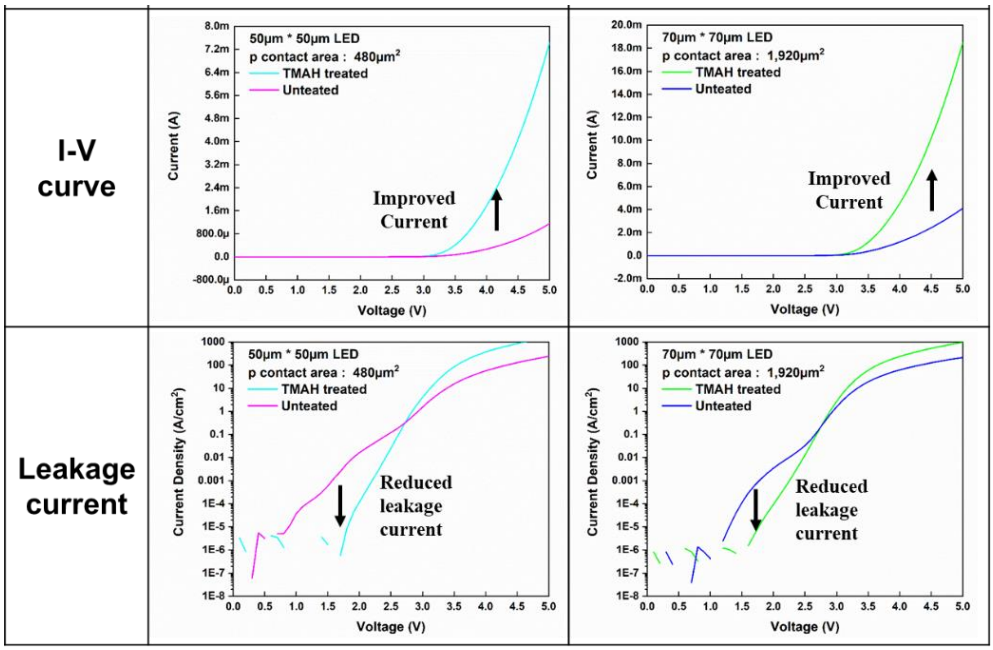

Figure 1. The I-V and Leakage current of designed LED with and without TMAH treatment.

Reference: [1] Appl. Phys. Express 12, 097004 (2019). [2] Sci. Rep. 8, 7922 (2018). [3] J. Mater. Chem. C 3, 8873 (2015).