Vertical GaN Schottky Diodes Grown On Highly Conductive Ammono-GaN Substrate

P. Kruszewski [1,2], **M. Grabowski** [1], **P. Prystawko** [1,2], **T. Sochacki** [1,2], **J. Jasinski** [3], **L. Lukasiak** [3] and **M. Leszczynski** [1,2]

[1] *Institute of High Pressure Physics, Polish Academy of Sciences, Sokolowska 29/37, 01-142 Warsaw, Poland*
[2] *Top-GaN Ltd, Sokolowska 29/37, 01-142 Warsaw, Poland*
[3] *Institute of Microelectronics and Optoelectronics, Warsaw University of Technology, Koszykowa 75, 00-662, Warsaw, Poland*

Wide bandgap semiconductors have become one of the most investigated materials for applications in high power, high voltage and high frequency electronic devices operated in elevated temperatures. Gallium nitride (GaN) is one of the most promising candidate in this field thanks to high critical electric field, wide energy bandgap and high value of electron saturation velocity. However, most of the previously fabricated GaN-based electronic devices such as diodes or FET transistors suffered from lateral geometry of current flow in the active region what limited the maximum current in the device. The reason of that was a lack of native and highly conductive GaN substrates. Since few years, high quality and low dislocation density GaN substrates are commercially available and thus this limitation has been overcame [1,2]

In this paper, we report on electrical parameters of n-GaN high voltage Schottky diodes with vertical current flow in the structure. The samples analyzed here were grown by Metal Organic Chemical Vapour Deposition (MOCVD) and Hydride Vapour Phase Epitaxy (HVPE) growth technique. For both sample sets, n-GaN drift region of 2-5x10^{16} cm^{-3} has been prepared on highly conductive n+ Ammono-GaN substrate (n~1x10^{19} cm^{-3}). Drift region thickness differed from 2um to 150um for MOCVD and HVPE samples, respectively. The Schottky diodes were then fabricated using standard Ni/Au metallization and photolithography techniques. The diodes surface was not passivated in this case.

We compared and discussed the results of Schottky barrier height (SBH), ideality factor (n), breakdown voltage (Vbr) and on-resistance (Ron) extracted from commonly used thermionic emission approach. Finally, we observed large difference in breakdown voltage, Vbr as high as 750V for HVPE sample.

[1] www.ammono.com
[2] http://global-sei.com/sc/products_e/gan/

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