

## Comparative Study of Al<sub>2</sub>O<sub>3</sub> and HfO<sub>2</sub> as Gate Dielectric on AlGaIn/GaN Metal Oxide Semiconductor High-Electron Mobility Transistors

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**Abstract :** We have made a comparative study on the influence of Al<sub>2</sub>O<sub>3</sub> and HfO<sub>2</sub> grown using atomic layer deposition (ALD) technique as dielectric in the AlGaIn/GaN metal oxide semiconductor high electron mobility transistor (MOS-HEMT) structure. Five samples consisting of 20 nm and 10 nm each of Al<sub>2</sub>O<sub>3</sub> and HfO<sub>2</sub> respectively and a Schottky gate HEMT, were fabricated and measured. The threshold voltage shifts towards negative by 0.1 V and 1.8 V for 10 nm thick HfO<sub>2</sub> and 10 nm thick Al<sub>2</sub>O<sub>3</sub> gate dielectric layers respectively. The negative shift for the 20 nm HfO<sub>2</sub> and 20 nm Al<sub>2</sub>O<sub>3</sub> were 1.2 V and 4.9 V respectively. Higher gm/IDS (transconductance to drain current) ratio was also obtained in HfO<sub>2</sub> than Al<sub>2</sub>O<sub>3</sub>. With both materials as dielectric, a significant reduction in the gate leakage current in the order of 10<sup>-4</sup> was obtained compared to the sample without the dielectric material.

**Keywords :** AlGaIn/GaN HEMTs, Al<sub>2</sub>O<sub>3</sub>, HfO<sub>2</sub>, MOSHEMTs.

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