

## Improvement in Opto-Electrical Properties of GaN MSM Photodetector by Contact Work-Function Selection

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Overall, this work evaluates the role of different metal contacts in improving electrical properties of GaN MSM (metal-semiconductor-metal) photodetector. The metal contacts were investigated in this work are Al, In, Pt, ITO and ZnO. Prior to the metalization, GaN layer was deposited on *m*-plane sapphire ( $\text{Al}_2\text{O}_3$ ) substrate using electron beam (e-beam) evaporator, followed by ammonia annealing treatment to improve III-V stoichiometric balance. Subsequently, a metal mask consisting of two terminals, each with 3 inter-digitized fingers was aligned over  $\sim 9 \text{ mm}^2$  of the GaN samples. Contacts on each MSM photodetector were deposited by either RF/DC sputtering. Next, each GaN MSM photodetector were annealed at  $400^\circ\text{C}$  for 10 minutes in ambient air to diffuse the metal contact layer into the GaN layer. The best spectral response of the GaN MSM was observed at  $\sim 360 \text{ nm}$ . GaN MSM photodetector with Pt contact shows a Schottky IV curve due to the large contact work-function. On the other hand, ohmic IV curve was observed on the remaining GaN MSM photodetector. IV measurement under dark and illuminated conditions shows a gain of  $\sim 34$  times between bias voltage of 1.5 V to 5.0 V. Responsivity measurement under pulsing UV light illumination was conducted to investigate the rise and fall time for each GaN MSM photodetector.