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THE EFFECTS OF ANNEALING TREATMENT ON GaN-BASED UV PHOTODETECTORS

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ABSTRACT

The III-V nitrides (GaN and AlGaN) are wide band gap semiconductor materials, having excellent properties for fabricating electronic as well as optoelectronic devices operating under high-temperature and high-power conditions. The III-V nitrides are ideal photodetector materials operating at a detection range of between 240-360nm, with long wavelength response cut-off, which is directly related to the band gap of the material in the active region and thus does not require external filters. Low dark current detectors are extremely important to produce a photodetector with high detectivity, where the limitation to a photodetector's detectivity is due to the photodetector's noise level. The achievement of low dark current is critical to producing a UV photodetector with a high signal-to-noise ratio.

In this work, GaN-based metal-semiconductor-metal (MSM) ultraviolet (UV) photodetectors with nickel (Ni) Schottky contacts were fabricated and characterized. A comparative study of annealing treatment at various temperature (400°C-700°C) to the photodetectors' dark current level were carried out. Cryogenic cooling after the annealing treatment was also performed to determine the effects of this treatment to the devices' performance. Electrical characterization was performed by current-voltage (I-V) measurement to investigate the Schottky contact properties of the photodetectors.

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