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Abstract
Leakage properties of nitride based photodetectors (PDs) subjected to Inductively Coupled Plasma (ICP) etching has been investigated by using Emission Microscopy Inspection. ICP etching would cause significant damage on GaN metal-semiconductor-metal (MSM) photodetectors (PDs). The damage was proved to induce leakage current via the conductive surface of device by using emission microscopy inspection. However, the surface damage of MSM PDs can be partially recovered by depositing SiO2 passivation layer. The p-i-n PDs with SiO2 passivation layer either by E-beam SiO2 or Plasma Enhanced Chemical Vapor Deposited (PECVD) techniques were also fabricated and characterized. As for the passivation for p-i-n PDs, the effect is not significant in the reduction of dark current due to smaller etched area as compare to the whole area of p-i-n PDs. The reponsivities characteristics and leakage current path analysis of p-i-n PDs with different SiO2 passivation layers had also been investigated. The p-i-n PD served SiO2 passivation layer by PECVD technique collected the highest responsivity and the least leakage current. The leakage current path analysis of p-i-n PDs by EMMI technique had also been investigated. The p-i-n PD served SiO2 passivation layer by PECVD technique also collected the best observation result. We also performed stress experiment for p-i-n PDs to compare the effect of SiO2 passivation layer. The p-i-n PD served SiO2 passivation layer by PECVD technique remained better characteristics than other samples. In summary, the PD served SiO2 passivation by PECVD technique was proved to be a potential process to improve the reliability of p-i-n PDs.
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