High Deep UV Rejection MOS GaN Photodetector with Nano Oxide

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ABSTRACT

In this thesis, the ultraviolet (UV) GaN-based Metal-Oxide-Semiconductor photodetectors (MOS-PDs)has been fabricated, in which the oxide layer was prepared by using spin nano-particle or liquid-phase-deposition (LPD) oxide. The transparent indium tin oxide (ITO) gate electrode was deposited onto oxide by RF sputtering system having plasma power of 200 W. The Ohmic contact was formed by using Ti/Al alloy metals. A deep ultraviolet of 254 and 366 nm light source was illuminated on the MOS photodetector. It was found that the MOS-PDs with nano-particle oxide exhibited a higher rejection ratio between 254 and 366 nm than that of LPD-oxide by a factor of 277, however compared to the PECVD-oxide by a factor of 349. It was also found that after annealing at 800 °C in N2 atmosphere, the low density of interface trap state and oxide trap charge of 9.67×1010 cm-2eV-1 and 6.1×1010 cm-2 were obtained, respectively. According to above results, we successfully used nano-particle oxide to grow silicon oxide layer on GaN-based UV-MOS photodetector. The MOS photodetector has a superior contrast between 366 (UV-A) and 254nm (UV-C) wavelength. Nano-particle oxide MOS-PDs demonstrated responsivities of 130.1mA/W and 5.57mA/W, corresponding to a device quantum efficiency were 44.1% and 2.72% at 366nm and 254nm with a 10V applied bias, respectively.

Keywords : GaN ; LPD ; Nano-particle ; MOS ; Photodetector ; Rejection

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