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Performance analysis of a Pt/n-GaN Schottky barrier UV detector

F. Bouzid, L. Dehimi, F. Pezzimenti

Abstract: The electrical and optical characteristics of an n-type gallium nitride (GaN) based Schottky barrier ultraviolet (UV) detector, where a platinum (Pt) metal layer forms the anode contact, have been evaluated by means of detailed numerical simulations considering a wide range of incident light intensities. By modeling the GaN physical properties, the detector current density-voltage characteristics and spectral responsivity for different (forward and reverse) bias voltages and temperatures are presented, assuming incident optical power ranging from 0.001 to 1 Wcm-2. The effect of defect states in the GaN substrate is also investigated. The results show that, at room temperature and under reverse bias voltage of -300 V, the dark current density is in the limit of 2.18×10-19 Acm-2. On illumination by a 0.36-μm UV uniform beam with intensity of 1 Wcm-2, the photocurrent significantly increased to 2.33 Acm-2 and the detector spectral responsivity reached a maximum value of 0.2 AW-1 at zero-bias voltage. Deep acceptor trap states and high temperature strongly affected the spectral responsivity curve in the considered 0.2 μm to 0.4 μm UV spectral range.

Keywords : Gallium nitride, Schottky barrier, ultraviolet detector, photocurrent, responsivity, Temperature