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Numerical simulation study of a high efficient AlGaN-based ultraviolet photodetector

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Abstract: In this paper, a two-dimensional (2D) numerical simulation study of a p+-n-n+ AlGaN-based ultraviolet (UV) photodetector, which is designed to achieve true solar blindness with a cutoff wavelength of 0.31 μm, is presented. The device performance is evaluated by investigating both the current density-voltage characteristics and the spectral response (SR). The proposed structure is optimized in terms of the fundamental geometrical and doping parameters. During the simulations, it was found that the detector is sensitive to the UV rays in the 0.155-0.37 μm wavelength range and the spectral response can reach 0.156 AW-1 under a light intensity of 1 Wcm-2 at zero-bias voltage and room temperature. This SR peak value increases further under reverse bias conditions. The temperature effect on the detector SR and the impact of an explicit trap concentration located into the p+ and n-region are also investigated. The spectral response decreases for a temperature exceeding 420 K. At the same time, the SR reference values begin to be affected only for acceptor and donor trap densities that are much higher than the local (total) doping concentration.

Keywords : AlGaN, Numerical simulation, Photodetector, Spectral response, Trap Density