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Dark current mechanisms and spectral response of SiO_2-passivated photodiodes based on InAs/GaSb superlattice

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ABSTRACT

The electrical performance of SiO_2 passivated type-II superlattice double heterostructure photodiodes is demonstrated. Compared to unpassivated samples, a dark current of 4.009×10^{-5} A/cm^2 and the corresponding differential resistance-area of 165.82 Ω.cm^2 at zero bias voltage are achieved at 77 K. The temperature-dependence and bias-dependence of the dark current are studied experimentally. According to fitting results, the existence of the SiO_2 passivated layer alters the band bending at the interface, which influence the generation-recombination and trap-assisted tunneling current and then it present that the total dark current is reduced by introducing the SiO_2 passivation technology. At 77 K, the corresponding spectral responsivity and detectivity of the samples are measured at a bias voltage of -50 mV and the 100% cutoff wavelength is determined to be 10.6 μm, which is fitted well with the simulation results of temperature dependence of experimental data.

Keywords: InAs/GaSb; Passivation; Dark current; Mechanism.

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