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Dark current of photodetectors based on multilayer structures with quantum dots

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This paper describes the behavior of a multilayer photodetector with germanium quantum dots in silicon and its parameters under various operating conditions. The issues of optimizing the growth conditions in the method of molecular beam epitaxy to increase the efficiency of infrared photodetectors with quantum dots are considered. Multilayer heterostructures with germanium quantum dots on the silicon surface were chosen as a model material system for theoretical studies. In the present work, a theoretical model has been developed to take into account the presence of several layers of quantum dots in photodetectors, as well as the mismatch of quantum dots in size. The noise and signal characteristics of infrared photodetectors based on heterostructures with germanium quantum dots on silicon are calculated. The dark currents in such structures caused by thermal emission and barrier tunneling of carriers are estimated. To test the model, we compared the theoretical values of the dark current with the experimental results obtained in the works of other researchers.

Keywords: Infrared photodetectors, dark current, noise characteristics, nanoheterostructures, molecular beam epitaxy, quantum dots.

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