Conduction Band Inter-Sublevel Absorption of Infrared Radiation in (In,Ga)As/GaAs Quantum-Dot Nanostructures

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One of the potential applications of quantum-dot nanostructures is in the detection of infrared radiation spanning the spectral band between 5 and 12 μm. The interest in this wavelength band is connected with spectroscopic and night-vision applications. For this band, the equivalent energy level separations between the states involved in the absorption transitions is between 103 and 248 meV. Semiconductor nanostructures synthesized from the (In,Ga)As alloy system on GaAs substrates have quantum-confined conduction band energy level separations in this range.

This paper will review the status of infrared detectors fabricated from (In,Ga)As/GaAs quantum dots. It will highlight their advantages and disadvantages. Theory predicts that the performance of quantum-dot infrared detectors should be equal to or better than that of quantum-well infrared detectors. The experimental evidence so far has proven otherwise. Some of the reasons for this shortfall will be discussed, and new approaches to improving the performance of the devices suggested.