MULTI-COLOR, MID-INFRARED QUANTUM DOTS IN A WELL PHOTODETECTORS

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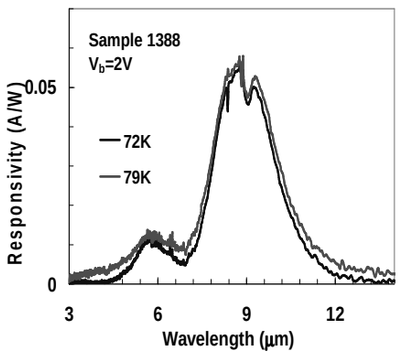
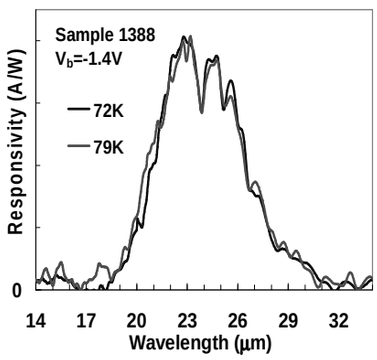
Mid-infrared detectors based on intersubband transitions in quantum dots are being actively researched. In our research group, a novel dots-in-a-well (DWELL) design is being studied. In the DWELL heterostructure, InAs quantum dots are placed in a thin $In_{0.15}Ga_{0.85}As$ quantum well that is in turn placed in a GaAs matrix. This lowers the ground state of the QD thereby reducing thermal emission. By altering the thickness and composition of the InGaAs well, the operating wavelength and nature of transition can also be controlled. Moreover, the asymmetry of the DWELL electronic potential could be tapped to realize spectrally adaptive "smart" sensors, whose operating wavelength depends on the applied bias. Three-color DWELL detectors, operating at 78K, with spectral response in the mid wave ($\lambda_{p1} \sim 4\mu m$), long wave ($\lambda_{p2} \sim 8\mu m$) and very long wave ($\lambda_{p3} \sim 23\mu m$) infrared regime have been fabricated in our group as shown in Fig. 1. The DWELL system enables the investigation of novel physics as the carriers relax from the 3D continuum to a 2D quantum well and finally to a quasi-0D quantum dot. Time-resolved dynamics of the carriers were measured using femtosecond pump-probe spectroscopy at 3.9, 7.5, and 10 μm. The carrier dynamics and performance characteristics of the DWELL detectors will be discussed in the presentation.





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