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InAs quantum dots in a $GaAs_{1-x}Sb_x$ matrix for intermediate band solar cell[1] YANG CHENG, MUKUL DEBNATH, VINCENT R. WHITESIDE, TETSUYA MISHIMA, MICHAEL B. SANTOS, IAN R. SELLERS, University of Oklahoma, LUCAS PHINNEY, KHALID HOSSAIN, Amethyst Research Inc. — Self-assembled InAs quantum dots (QDs) were grown by the migration-enhanced epitaxy (MEE) technique in a $GaAs_{1-x}Sb_x$ matrix material on a GaAs substrate for application as intermediate band single junction solar cells. Initially, a series of InAs QDs structures were studied with a nominal deposition of 1.75 – 3.5 ML and Sb concentration of $x = 0.13$. The areal density measured by atomic force microscopy was observed to increase with total deposition to a maximum of $\sim 4.0\text{x}10^{11}/\text{cm}^2$ after ~ 3 MLs. A high QD density is required to facilitate the formation of an intermediate band (IB) within the band gap of the matrix material. With increasing QD density a simultaneous increase in the optical emission is also observed. The promise in this system is the potential to form a degenerate valence band offset, while forming an IB in the conduction band. As such, a second series of QDs was investigated in which the concentration of Sb in the matrix varied from $x = 0.10$ to $x = 0.18$. The transition from type-I band alignment to type-II is observed. Temperature and power dependent photoluminescence, along with 8 band $k \cdot p$ calculations of the band structure will also be presented.

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