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Study of vertical correlation in type-II ZnCdTe/ZnCdSe submonolayer quantum dots for efficient intermediate band solar cells.[1] SIDDHARTH DHOMKAR, IGOR KUSKOVSKY, Department of Physics, Queens College and the Graduate Center, CUNY, NY 10016, UTTAM MANNA, ISMAIL NOYAN, Department of Applied Physics and Applied Mathematics, Columbia University, NY 10027, MARIA TAMARGO, Department of Chemistry, City College and the Graduate Center, CUNY, NY 10016 — Intermediate band solar cells (IBSCs), having an intermediate band (IB) of states within the bandgap of the host semiconductor that enhances the light absorption without reducing the open circuit voltage, are substantially more efficient than single-gap devices. The IB, in principle, can be fabricated using quantum dots (QDs) embedded in the host semiconductor; however, there are many growth and material issues related to fabricating practical devices. We tackle some of these problems by growing the type-II ZnCdTe/ZnCdSe submonolayer QD system that lack the wetting layer. We present results of high resolution x-ray diffraction based reciprocal space map studies, complemented by photoluminescence, showing that this material system is an excellent candidate for IBSCs. Specifically, we found that the sample with larger Te fractions has larger QDs with increased vertical correlation. The vertical correlation is particularly important to have sufficient overlap of the hole wavefunctions, to facilitate the IB formation in this material system.

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