Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Investigation of spatial correlation of type-II ZnTe quantum dots embedded in ZnCdSe barriers UTTAM MANNA, ISMAIL NOYAN, GERTRUDE NEUMARK, APAM, Columbia University, SIDDHARTH DHOMKAR, BIDISHA ROY, IGOR KUSKOVSKY, Queens College of CUNY, The Graduate Center of CUNY, RICHARD MOUG, City College of CUNY, LE PENG, MARIA TAMARGO, City College of CUNY, The Graduate Center of CUNY —
Doped and undoped multilayered structures of ZnTe type-II quantum dots (QDs) embedded in a ZnCdSe matrix have been grown in order to investigate the formation of an intermediate band, lying within the ZnCdSe band gap, with the aim of absorbing photons with energies below ZnCdSe bandgap. These materials may be useful for intermediate bandgap solar cells. The reciprocal space map (RSM) of the ZnTe/ZnCdSe multilayer QD structure consisting of periodic superlattice peaks in the q_x direction have been studied for two different ZnCdSe spacer thicknesses ($d_A \approx 3.5$, $d_B \approx 1.5$ nm). The ZnTe QDs give rise to diffuse scattering in RSM, which is found to be elongated in the q_x direction for both samples indicating a vertical correlation of the QDs. From the widths of the diffuse maxima in the q_z direction, we found that 16% and 40% of QDs are correlated vertically for $d_A \approx 3.5$ nm and $d_B \approx 1.5$ nm, respectively. With increasing correlation, the pairing probability of the dots increases, leading to a larger average QD size. This conclusion is supported by a smaller blue-shift (26 vs 36 meV) of the photoluminescence peak position with increasing excitation intensity, over five orders of magnitude, for the structure with narrower spacers.

Uttam Manna
APAM, Columbia

Date submitted: 11 Nov 2011 Electronic form version 1.4