Volume 12

Washington University
Undergraduate Research Digest

Spring 2017

Photoluminescence of CdTe Quantum Wires

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The main objective of this research was to investigate the photoluminescence (PL) properties and the dynamics of excitons prepared in CdTe Quantum Wires (QW). Specifically, I measured the PL spectra as a function of position along single CdTe QWs to investigate the uniformity of the energy band gap along them. Deviations occurred due to small changes in the diameter of the QW or to variations in the organic ligands that are bound to the surface of the QW. I also measured the PL lifetimes, which are inversely proportional to the electron and hole radiative recombination rates. I worked towards preparing these measurements under low temperature settings as well to investigate the role translation kinetic energy has on the dynamics and lifetimes of the excitons. I used photo/thermo-enhancement techniques created by the lab to increase PL and quantum yield (QY). I accumulated a collection of wires that were successfully imaged with a consistent photoluminescence peak. The individual wires consistently emitted photons at a higher frequency than the ensemble batches. Additionally the quantum yields maintained consistently above the QY throughout the summer, which indicates that, the photo-enhancement methods were successful. The data collected can provide information regarding the limits that can be expected in semiconductor QWs, but also general insights into how the specific properties of a QW and the potential energy landscape along it effect the momentum of excitons and the nature of radiative recombination.