

Nanoelectronics Undergraduate Research Fellowship (NURF) 2010 Project Summary

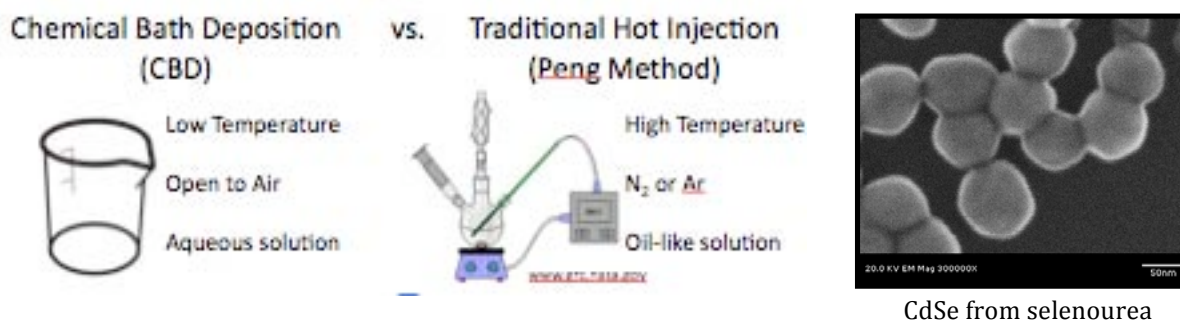
Student name: Conor Wolohan

Faculty mentor name: Dr. Luis C. Fernandez-Torres

Project Title: “Synthesizing and evaluating the morphology of inorganic materials for solar cells”

Problem / Problem Area: The synthesis of semiconductor nanostructures with controlled morphologies has been of interest in recent years. The dependence of their physical properties on their size and shape affords the ability to engineer unique applications for functional nanodevices, such as quantum dot solar cells. Synthesis of these nanostructures becomes easier and affordable when carried out in near ambient conditions, as opposed to the traditional hot injection method. In short, the objective was to synthesize nanostructures of ZnS, ZnSe, CdS, and CdSe in aqueous media Chemical Bath Deposition that would be morphologically similar to hot injection synthesis, and would thus perform similarly in solar cell devices. The hypothesis was that the nanostructures synthesized in aqueous solution would compare favorably with Peng Method Nanostructures.

Activities / Results: By combining one metal source ($\text{Zn}(\text{NO}_3)_2$ or $\text{Cd}(\text{NO}_3)_2$) with a Sulfur or Selenium source (Thiourea, Thioacetamide, or Selenourea) and a reducing agent (Hexamethylenetetramine) at 60-75°C, each of the four aforementioned nanostructures was synthesized. Through Scanning Electron Microscopy imaging, CdSe was found to be composed of the smallest and most homogeneous nanoparticles. Further evidence was provided through Ultraviolet Spectroscopy, which showed CdSe to absorb in the visible light range (580 nm), indicating that the particles are 3-8 nm in size. The next experiment would involve binding the CdSe sample to TiO_2 molecules and placing them on a solar cell device. If the photon emission were measured to be identical to that of CdSe samples synthesized through the more tedious Peng method, the hypothesis would be proven. This experiment is underway.



The results for this project were presented in the poster, titled “Synthesizing and Evaluating ZnS, ZnSe, CdS, and CdSe Semiconductor Nanostructures For Potential Solar Cells”.