

The Summer Undergraduate Research Fellowship (SURF) Symposium

6 August 2015

Purdue University, West Lafayette, Indiana, USA

Dissolution of Chalcogens in Amine Thiol Solvents for Use in Nanoparticles

Gaurav Mittal, Caleb Miskin, Rakesh Agrawal
Department of Chemical Engineering, Purdue University

Lead chalcogenide quantum dots have been shown to be ideal materials for solar cells due to their tunable band gap. Developing a dissolution procedure for chalcogens will help lower the production cost of the solar cells produced by the associated nanoparticles. Dissolution was performed in both aqueous and nonaqueous solutions. Precursors for sulfur and selenium were dissolved in both the aqueous solution of ammonium thioglycolate and ammonium hydroxide and in combinations of amines and thiols. Precursors for tellurium were dissolved in ethylenediamine and different thiols. Lead telluride forms larger microparticles that can be suitable for thermoelectric devices. The optimum solutions and solvent ratios were determined by analyzing XRD, SEM, and TEM of the nanoparticles. The results from these characterizations also helped identify which nanoparticles were the right sizes for quantum dot solar cells and for thermoelectric devices. The lead sulfide nanoparticles that were synthesized were around 5-10 nanometers in size. This dissolution process will help to further advance the knowledge on low energy payback times for nanoparticle synthesis processes.

Keywords: lead chalcogen, nanoparticles, quantum dot, dissolution, amine thiol