Effects of [Cu]]/[In] molar ratio to properties of [CIS]/[ZnS] quantum dots

By: Fontenot, Alicia; Nguyen, Anh; Robinson, Colette; Heyes, Colin D.

Abstracts, 74th Southwest Regional Meeting of the American Chemical Society, Little Rock, AR, United States, November 7-10 (2018), SWRM-357 | Language: English, Database: CAplus

Nanoparticle synthesis is the foundation in which nanotechnol. is built on. An important class of nanoparticles is semiconductor nanoparticles, also called quantum dots, as they can be made to be highly fluorescent with emission wavelength tunable by size. The study of CIS/ZnS (core/shell) QDs is beneficial to the advancement of multicolor imaging due to the advantages of copper-based QDs. This project focuses on synthesizing Copper Indium Sulfide/Zinc Sulfide (CIS/ZnS) quantum dots. CIS/ZnS QDs are a relatively new composition and have great potential at replacing the more common, but toxic Cd-containing CdSe QDs. In contrast to cadmium-based QDs, copper-based QDs offer properties more advantageous for the development of bioimaging. These QDs have longer lifetimes and are smaller in diameter which promotes bioavailability in organisms. Also, CIS/ZnS QDs are alternatives to Cd-based QDs because cadmium is a known carcinogen and presents a health hazard to organisms. Ultimately, this research aims to discover optimal parameters that will produce sustainable, non-toxic, and highly fluorescent QDs for future applications; however, the desired properties of QDs are very dependent on its anticipated applications, of which an important one is bioimaging. Measurements of the temperature and time dependence of the change in optical and elemental composition properties were taker as ZnS was added to the CIS QDs to form the core/shell CIS/ZnS material to gain thermodn. and kinetic information on the shelling process. It was subsequently found that using a 1:4 ratio of Cu:In during CIS synthesis led to much higher fluorescence quantum yield (QY) QDs. The goal of this research project is to compare the mechanisms of shelling these 1:4 Cu:In CIS QDs with the aforementioned 1:1 Cu:In CIS QDs previously measured in past experiments