Characterization of Functionalized Silicon Nanoparticles

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Project Overview

Our group uses a mechanochemical procedure for the synthesis of alkyl passivated silicon nanoparticles using high energy ball milling (HEBM). The main advantage of this mechanochemical approach is the simultaneous production of silicon nanoparticles and passivation of the particle surface with alkyl groups covalently linked through Si-C bonds. As fresh silicon surface is formed due to particle fracture, surface atoms react in situ with liquid alkyls, such as 1-octyne. Functionalized silicon nanoparticles of a certain size become solubilized in the hydrocarbon, and are easily separated from the reaction mixture. The fluorescent nanoparticles are then characterized using spectroscopic techniques such as photoluminescence, NMR, and IR. The potential uses for these unique nanoparticles include fluorescent dye markers in biological cells, solar energy collection, and electronic displays. The goal of this project is to extend the current state of knowledge in this area to new chemistries and materials; e.g., functionalized aluminum nanoparticles.

Project Objectives

- To work with the current graduate student involved in the process to learn about how functionalize silicon nanoparticles are produced.
- To investigate the optimal concentration of Alkyne to Alkane
    - Necessary work: Milling
    - Yield measurements
    - Photoluminescence measurements
    - FTIR measurements
    - TGA
    - GPC
- To investigate the stability of functionalized silicon nanoparticles
    - determine the optimal storage solution by using other organic solvents like Toluene instead of Alkynes and Alkanes.
    - Photoluminescence measurements

Prerequisites

Completion of sophomore year in any of the natural or physical sciences or engineering. Student should have completed calculus, physics and chemistry sequences. Good communication skills and an ability to work with one's hands are a must.