Solution Synthesis and Optical Properties of Silicon Nanocrystals for Biomedical Imaging

B. F. P. McVey, X. Cheng, J. J. Gooding, R. D. Tilley

School of Chemistry and Australian Centre for NanoMedicine, The University of New South Wales, Sydney, NSW 2052, Australia. r.tilley@unsw.edu.au

Silicon Nanocrystals (Si NCs) are an interesting class of semiconductor nanocrystals due to their unique optical properties, high natural abundance, and low toxicity. The size and surface dependent optical properties of Si NCs combined with its low toxicity give it a strong future in applications including bioimaging. Tuning the optical properties of Si NCs is a significant synthetic challenge. Key areas to improve include tuning the emission range, which if addressed will lead to dramatic improvements in Si NC applications in bioimaging.

This presentation will discuss the synthesis and characterization of Mn, Ni, and Cu doped Si NCs, highlighting their unique dopant dependent optical properties. Doped Si NCs were produced through use of strong hydride reducing agents to co-reduce metal dopant and silicon salt in the presence of quaternary amine surfactants. Doped Si NCs were shown to be highly monodisperse with comparable size to pure Si NCs by transmission electron microscopy. The optical properties of doped Si NCs were studied by ultraviolet-visible spectroscopy, photoluminescence spectroscopy (PL).

Doped Si NCs demonstrate enhanced optical properties for biomedical imaging including higher quantum yields and red shifted emission compared to pure Si NCs enabling improved cell imaging Figure 1.

References


Figure 1: Fluorescence Images of silicon and Cu doped silicon quantum nanocrystals.