Silicon Quantum Dots

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Quantum dots and nanoparticles have found commercial uses in numerous applications such as displays, lighting, photovoltaics, bio-reagents, and personal care formulations. Control of the crystalline core size and functionalization of particle surfaces are critical to enable unique material properties that allow for these applications to be realized. This presentation will review the work on silicon quantum dots at Dow (previously Dow Corning).

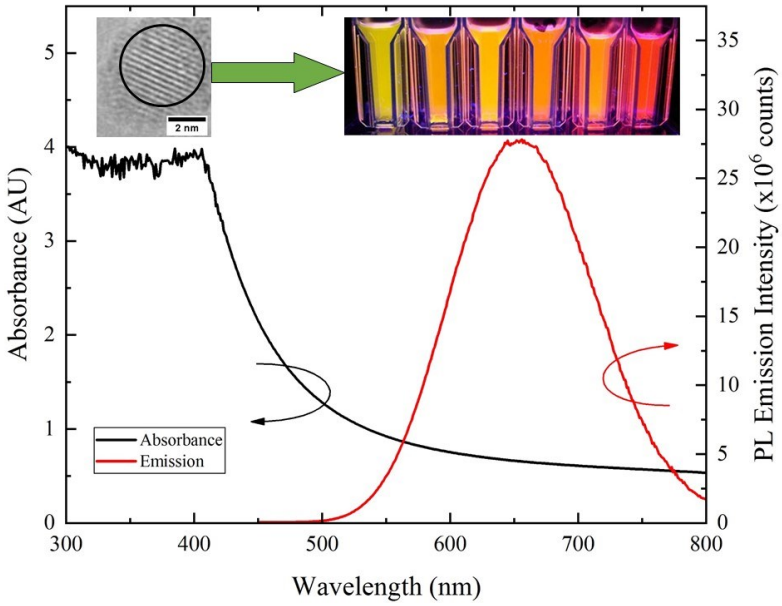

Figure 1. Absorbance and photoluminescence emission spectra (excited at 365 nm) of Dow's silicon quantum dots. TEM image of a single silicon quantum dot and image of different dispersions of silicon quantum dots and PDMS illuminated with 365 nm light source.

A bottom-up approach via a very high frequency plasma synthesis of silicon quantum dots with novel dispersion and functionalization schemes provides superior size control (mean particle size from 2.5 – 5 nm with size distribution of ~ 10%), exceptionally low lot-to-lot variability (mean diameter coefficient of variation of 1.18% after 6 years of storage), and the ability to disperse the particles in different matrices (silicones, hydrocarbons, alcohols, natural oils, and water). These unique capabilities promise to advance silicon within the quantum dot arena.