Photoluminescence of rare earth doped upconverting NaYF4 nanoparticles

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Upconversion is a phenomenon in which multiple photons of lower energy are converted to higher energy light. This effect can be observed in systems of rare earth ions doped in an inorganic host matrix to convert near infrared light to visible photoluminescence. The photoluminescence is highly dependent on the rare earth ions and host matrix used. The wavelength of visible emission is tuned via the rare earth ion while the intensity is dependent on the phonon energy of the host. In this study, upconverting nanoparticles with improved photoluminescence have been prepared via a thermal decomposition preparation method.

The conversion of near infrared light to visible light is achieved using Er3+ and Yb3+ ions doped into an NaYF4 lattice. The photoluminescence properties of the nanoparticles is dependent on the crystalline phase of the NaYF4 lattice. The selective formation of the crystal phase is achieved via control of the reactant concentrations during the nucleation phase of nanoparticle formation. The optimized synthesis has been shown to create pure hexagonal nanoparticles with a high degree of crystallinity. The photoluminescence of the nanoparticles was studied using low power NIR light (980 nm) to excite emission in the red and green portions of the visible spectrum.