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Detection of aqueous uranyl(VI) species using rare-earth upconversion nanophosphors

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Upconverting nanophosphors (UCNPs) are typically composed of an inorganic lattice doped with luminescent lanthanide ions and demonstrate the ability to convert long-wavelength excitation in the near-infrared (with wavelengths of typically 800-1000 nm) into higher energy visible luminescence. Such materials display several advantages in analytical applications, in comparison to other fluorophores, including low autofluorescence and scattering of excitation radiation, reducing background noise. Lanthanides display multiple very specific emission bands allowing careful tuning of the emission profile of the UCNPs. These properties make them suitable candidates as the donor species in luminescence resonance energy transfer (LRET) in chemical sensors and biosensors. This project details the design of a chemical sensor based on Gd_4O_2S:Yb,Tm and Gd_4O_2S:Yb,Er UCNPs. A proof of principle technique for the detection of uranyl(VI) species in aqueous solutions has been developed. Luminescence resonance energy transfer efficiency is used to sense these species. Tm^{3+} and Er^{3+} doped upconversion nanophosphors exhibit emission bands at 475 nm and 410 nm respectively, which can be monitored by ratiometric analysis, relative to other emission bands. Recent work consists of improving the sensitivity of the current system to detect lower concentration of uranyl(VI) species.

Biography

Aruna Reddy completed her MSc in Manchester working on a project titled, *"Synthesis of organelle-specific inhibitors of deubiquitinating enzymes"* in 2013. She is currently a BBSRC funded PhD student on the Doctoral Training Partnership also at the University of Manchester under the supervision of Dr. Louise Natrajan and Dr. Sam Hay. She has also spent time at the National Nuclear Laboratory for several months working on separation of radionuclides.

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