

Controlling Photon Upconversion in Lanthanide-doped Nanocrystals

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Abstract: Lanthanide-doped nanoparticles exhibit unique luminescent properties, including a large Stokes shift, a sharp bandwidth of emission, high resistance to optical blinking, and photobleaching. Uniquely, they can also convert long-wavelength stimulation into short-wavelength emission. These attributes offer the opportunity to develop alternative luminescent labels to organic fluorophores and quantum dots. In recent years, researchers have taken advantage of spectral-conversion nanocrystals in many important biological applications, such as highly sensitive molecular detection and autofluorescence-free cell imaging. With significant progress made over the past several years, we can now design and fabricate nanoparticles that display tailorable optical properties. In particular, we can generate a wealth of color output under single-wavelength excitation by rational control of different combinations of dopants and dopant concentration. By incorporating a set of lanthanide ions at defined concentrations into different layers of a core-shell structure, we have expanded the emission spectra of the particles to cover almost the entire visible region, a feat barely accessible by conventional bulk phosphors. In this talk, I will highlight recent advances in the broad utility of upconversion nanocrystals for multimodal imaging, bio-detection, display and photonics.



Dr. Xiaogang Liu earned his BS degree (1996) in Chemical Engineering from Beijing Technology and Business University, China. He received his MS degree (1999) in Chemistry from East Carolina University in Greenville, North Carolina under the direction of Prof. John Sibert and completed his PhD (2004) in Chemistry at Northwestern University in Evanston, Illinois under the supervision of Prof. Chad Mirkin. In the same year he became a postdoctoral fellow in the group of Prof. Francesco Stellacci at MIT. He joined the faculty of the National University of Singapore in 2006. He holds a joint appointment with the Institute of Materials Research and Engineering, Agency for Science, Technology and Research. His interests include nanomaterials synthesis, supramolecular chemistry, and surface science for

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