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The Search for High Efficiency Energy Conversion Nanocrystals: A Personal Account

Professor Liu Xiaogang
Department of Chemistry
National University of Singapore

Abstract

Lanthanide-doped nanoparticles exhibit unique luminescent properties, including a large Stokes shift, a sharp emission bandwidth, and a high resistance to optical blinking and photobleaching. As a unique class of materials, 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 which display tailorable optical properties. In particular, we can generate a wealth of colour output under single-wavelength excitation by rational control of different combinations and concentrations of dopants. 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 achievable by conventional bulk phosphors. In this talk, I will highlight recent advances in the broad utility of up-conversion nanocrystals for multimodal imaging, bio-detection, display and photonics.

Biography

Professor Liu Xiaogang earned his B.E. degree (1996) in Chemical Engineering from Beijing Technology and Business University. He received his M.S. degree (1999) in Chemistry from East Carolina University under the tutelage of Professor John Sibert and completed his PhD (2004) at Northwestern University under the supervision of Professor Chad Mirkin. He then became a postdoctoral fellow in the group of Professor Francesco Stellacci at MIT. He joined the National University of Singapore in 2006 and holds a joint appointment with the Institute of Materials Research and Engineering. Currently, he is an Associate Editor for *Nanoscale* and serves on the editorial boards of *Chemistry – An Asian Journal*, *Advanced Optical Materials*, and *Journal of Luminescence*. His research encompasses optical nanomaterials and energy transfer, where he explores the use of luminescent nanocrystals for photocatalysis, sensing and biomedical applications.