Light Science & Applications

Approaches to anti-thermal quenching upconversion luminescence

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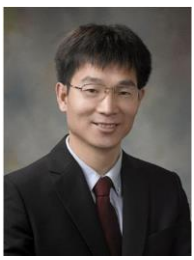
Thermal quenching (TQ) has been naturally entangling with luminescence since its discovery, and has severely restrained further applications particularly for lanthanide-based upconversion luminescence (UCL) due to its very low energy conversion efficiency. Various strategies have been developed to realize anti-TQ UCL, such as desorption of adsorbents on upconversion nanoparticles, energy compensation from defects inside crystallographic matrix, selection of hosts with rigid frameworks, and use of activator ions with thermally coupled energy levels by sacrificing the emission intensities of low energy levels. Herein, we will report our efforts on solving this issue and the design principles, so that anti-TQ UCL or even thermally enhanced UCL are realized and their respective applications explored, such as Frenkel-defect assisted anti-TQ UCL; fabrication of positive thermal expansion core/negative thermal expansion shell structure so that giant physical pressure can be generated upon hating, which suppresses the multi-phonon relaxation so that more photons can be used for luminescing; as well as other defects that can also supply energy to counteract that depleted by TQ.



Short Bio:

Ling Huang received his PhD degree in Inorganic Chemistry from Nanjing University, China. He is a professor of Xinjiang University and Nanjing Tech University, China.