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# Multicomponent nanocrystals with anti-Stokes luminescence as contrast agents for modern imaging techniques

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## Abstract

Lanthanide-doped upconversion nanoparticles (UCNPs) have recently attracted great attention in theranostics due to their exceptional optical and physicochemical properties, which enable the design of a novel UCNP-based nanoplatform for luminescent imaging, temperature mapping, sensing, and therapy. In addition, UCNPs are considered to be ideal building blocks for development of multimodal probes for cells and whole body imaging, exploiting simple variation of host matrix, dopant ions, and surface chemistry. Modalities responsible for magnetic resonance imaging (MRI), computed tomography (CT), and positron emission tomography (PET)/single-photon emission computed tomography (SPECT) are embedded in a single UC nanocrystal, providing integrating effect over any modality alone in terms of the efficiency and sensitivity for clinical innovative diagnosis through multimodal bioimaging. In particular, we demonstrate applications of UCNPs as a new nanoplatform for optical and multimodal cancer imaging *in vitro* and *in vivo* and extend discussions to delivery of UCNP-based therapeutic agents for photodynamic and photothermal cancer treatments.

**Keywords:** *upconversion nanoparticles, photoluminescent imaging, magnetic resonance imaging, computed tomography, positron emission tomography, single-photon emission computed tomography*

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