Scientific Achievement

We developed novel core/shell alkaline-earth rare-earth fluoride (M_{1-x}Ln_xF_{2+x}) UCNPs with overall size below 15 nm that are up to 5 times more efficient than the reference material β-NaGdF_4.

Significance and Impact

Our novel M_{1-x}Ln_xF_{2+x} core/shell UCNPs provide most efficient upconversion, which enables new possibilities in biological imaging and sensing (optogenetics), and energy-related applications.

Research Details

- Compared 36 unique UCNPs of 7 different host materials.
- Developed a hot injection method to grow shell layers.
- Measured and analyzed upconversion efficiency and lifetimes as a function of shell thickness.
- Achieved record upconversion efficiency in the small size regime which is 5x larger than the reference material.

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Work was performed at Stanford University and UC Berkeley