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Engineering Enhanced Optical Properties of Near-IR Upconverting Nanoparticles DANIEL GARGAS, ALEXIS OSTROWSKI, EMORY CHAN, DELIA MILLIRON, BRUCE COHEN, P. JAMES SCHUCK, The Molecular Foundry, Lawrence Berkeley Laboratory — Due to their unique properties in converting low energy light into higher energy electronic transitions, upconverting nanoparticles (UCNPs) have garnered considerable interest in bio-imaging, photovoltaic, and opto-electronic applications. In particular, lanthanide-doped UCNPs have demonstrated a host of functionalities due to their nanoscale dimensions, wide range in transition-metal doped compounds, and high photostability in both aqueous and ambient environments.[1] In addition, their mixed electric and magnetic dipole transitions make them ideal materials for study of plasmon-enhanced properties with metal nanostructures in which tunable surface properties can mediate energy transfer processes. Here we report on the luminescence properties of Er^{3+}, Yb^{3+}-doped $NaYF_4$ UCNPs with diameters ranging from 5 – 50 nm in both core and core-shell architectures. Optical characterization of the luminescence lifetime and spectral emission from both UCNP films and single particles reveal a strong dependence on particle size and surface functionalization. Furthermore, by utilizing the large shift (anti-stokes) in absorption energy versus transition energy, we investigate the interaction of energy transfer across metal-semiconductor nano-interfaces whereby the intrinsic luminescence lifetimes are probed for Purcell enhancement and emission rate modification.

[1]P.J. Schuck, et al *Proc. Nat. Acad. Sci.* **106**, 10917, 2009

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