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A New Class of Quantum Imaging Materials:50 nm Diameter Infrared Upconverting Phosphors. SHUANG FANG LIM, ROBERT RIEHN, CHIH-KUAN TUNG, ROBERT H AUSTIN, ALEX MCDONALD, DAVID TANK, Department of Physics, Princeton University — Upconversion phosphors (UCPs) convert infrared (IR) photons into visible light using stepwise excitation levels, so that inexpensive CW IR diode lasers can be used for multi-photon imaging. These phosphors are ideal candidates as biological markers, due to their high quantum yield, very rich spectral features, absence of photobleaching, and tunable emission from the red through the blue with IR excitation. The multiphoton intensity dependence gives rise to high spatial resolution confocal imaging possibilities. There is a complete lack of background fluorescence excitation in biological tissue with CW IR excitation, greatly enhancing sensitivity. We have succeeded in synthesizing spherical nanoparticles of 50 nm. We have also succeeded in modifying the surface of the UCP nanoparticles with a biotin-streptavidin coupling scheme, have demonstrated end-labeling of lambda DNA to the upconversion phosphors. We have also shown that electron beam excitation of these UPCs gives rise to complex emission patterns related to the optical patterns, so that both 2-photon confocal imaging and much higher resolution SEM imaging using optical detection is possible.

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