Synthesis and characterization of UCNPs for bioimaging applications

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Upconversion nanoparticles (UCNPs) are "new generation fluorophores" with unique luminescent properties, including: i) excitation via low energy near infrared radiation (NIR), ii) deep NIR-light penetration into biological tissue, iii) excellent signal-to-noise ratio and detection sensitivity, iv) physicochemical stability, and v) low toxicity [1,2]. Namely, rare earth-based UCNPs are excellent fluorescent labels that can absorb low energy long wavelength photons and emit high-energy short-wavelength photons through multi-photon transitions, converting the infrared light into visible light. These UCNPs have demonstrated great potential for *in vitro* and *in vivo* bioimaging and biodetection applications without significant toxicity [3]. In this work, UCNPs composed by $NaYF_4$:Yb,Er-SiO_2 were synthesized by a co-precipitation method from either oxide or nitrate rare earth elements followed by a TEOS coating step as a silica precursor. The obtained UCNPs were characterized in terms of their upconversion luminescence, host material crystalline phase and grain size (XRD), elements mapping and morphology (SEM-EDS). Finally, as these UCNPs also offered very low cytotoxicity, they were incorporated to 3D-printed aerogels for bioimaging purposes.

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