UV TO NIR EMITTING UPCONVERTING NANOPARTICLES FOR APPLICATIONS IN THERANOSTICS

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Theranostics is a field in medicine that combines diagnostic and therapeutic tools, either simultaneously or sequentially, to achieve more accurate detection and efficient treatment of cancer which stands as one of the leading causes of death worldwide [1-3]. Recently, inorganic lanthanide-doped nanoparticles (NPs) that exhibit upconversion luminescence (low energy photons absorbed are combined and emitted as the ones of higher energy) are gaining ground in theranostics [4]. Firstly, NPs are small enough to enter cancerous cells providing localized effects [5]. Secondly, upconverting NPs are excited using NIR radiation which pass deeper through tissues if compared to UV or visible radiation [6]. Furthermore, the luminescence of such particles has high signal to noise ratio that provides high contrast imaging [6]. However, for upconverting NPs to be applicable in theranostics, they must emit light at specific regions, determined by utilization envisioned. For instance, emission in red spectral region is necessary for photodynamic therapy, emission in UV or blue spectral region enables the release of drugs attached to the surface of the NPs, and emission in NIR region provides bioimaging using NIR camera [4,7,8]. It means that NPs emitting in multiple spectral regions would offer both diagnostic and therapeutic properties contained within a single type of NPs. All in all, upconverting NPs possessing the characteristics described above show great prospects towards a more precise diagnosis and treatment of cancer.

This presentation will describe synthesis and post-synthesis treatment of upconverting core-shell-shell structured $NaGdF_4$:15%Eu^{3+}@$NaGdF_4$:49%Yb^{3+},1%Tm^{3+}@$NaGdF_4$:5%Yb^{3+},40%Nd^{3+} NPs that emit light in the range from UV to NIR (see Fig. 1). Furthermore, the presentation will include detailed analysis of structural and optical properties of NPs produced along with evaluation of their colloidal stability (aqueous, biological media) and biocompatibility.

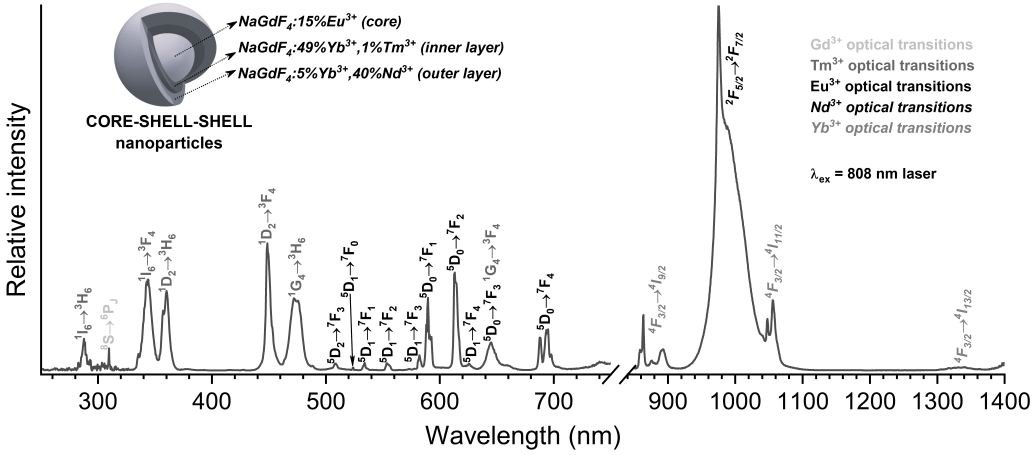

Fig. 1. Emission spectra of core-shell-shell NPs investigated under 808 nm laser radiation.

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