GARNET-TYPE NANOCRYSTALS FOR *IN VIVO* BIO-IMAGING AND NANOTHERMOMETRY

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Summary: Neodymium-doped garnets have been widely developed during roughly the last sixty years and have been an outstanding fluorescent material. It has been considered as the gold standard among multipurpose solid state lasers. Yet, the successful downsizing of this system into the nano regimen has been elusive, so far. Indeed, the synthesis of a garnet structure at the nanoscale, with enough crystalline quality for optical applications was found to be quite challenging.
First, I will present an improved solvothermal synthesis method producing Nd^{3+}-doped $Y_3Al_5O_{12}$ ($YAG:Nd^{3+}$) and $Gd_3Sc_2Al_3O_{12}$ ($GSAG:Nd^{3+}$) nanocrystals of remarkably good structural quality and controlled size in the range 50 to 200 nm.[1] These features allow for high photoluminescence efficiency, leading to the development of thermosensitive near-infrared (NIR) light-emitting nanoparticles. Second, I will show how to stabilize these $YAG:Nd^{3+}$ and $GSAG:Nd^{3+}$ nanocrystals in aqueous solutions, a key requirement for use in biomedical applications. Stabilization was successful achieved thanks to the use of asymmetric double-hydrophilic block copolymers, constituted of a metal-binding block and a neutral water-soluble block.[2] These newly stabilized $YAG:Nd^{3+}$ nanoprobes offer long lifetimes and, more importantly, narrow emission lines that have been exploited by differential NIR fluorescence imaging, thus achieving an autofluorescence-free *in vivo* readout at the deep tissue level.[2] Finally, nanothermometry measurements, based on the ratiometric fluorescence of the $YAG:Nd^{3+}$ and $GSAG:Nd^{3+}$ nanocrystals, will be presented. $GSAG:Nd^{3+}$ nanocrystals exhibit a maximal relative thermal sensitivity of 0.20 % $°C^{-1}$, higher than that of $YAG:Nd^{3+}$ nanocrystals due to the difference in the crystal field of the host matrices.[3] These results pave the way for the use of these garnet-type nanocrystals as multifunctional nanoplatforms for *in vivo* biophotonics.

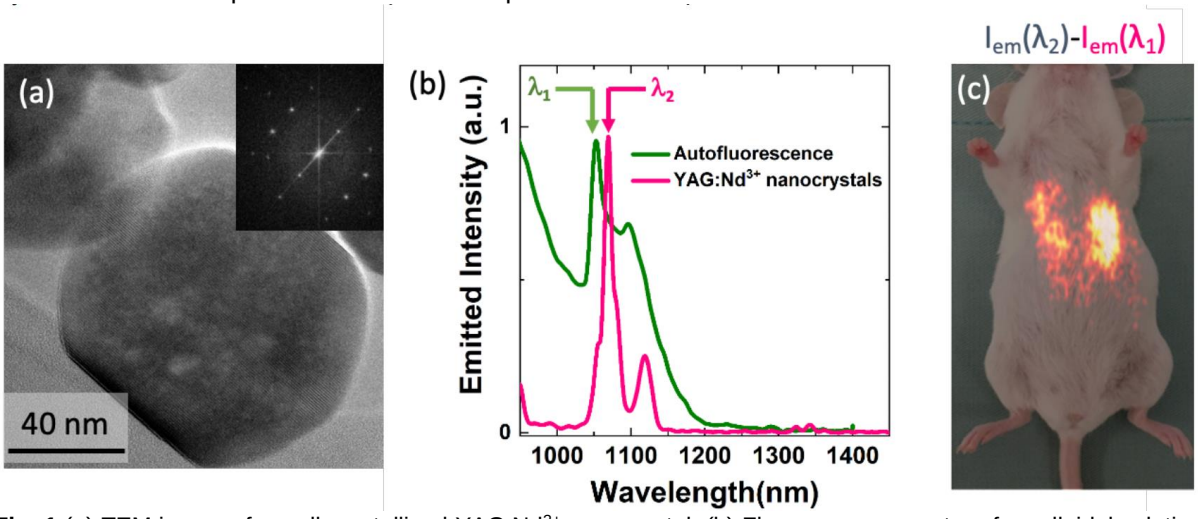

Fig. 1 (a) TEM image of a well-crystallized $YAG:Nd^{3+}$ nanocrystal. (b) Fluorescence spectra of a colloidal solution of stabilized $YAG:Nd^{3+}$ nanocrystals in PBS and of the whole body of a mouse (exc. 808 nm). (c) Differential hyperspectral fluorescence *in vivo* imaging with stabilized $YAG:Nd^{3+}$ nanocrystals.

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