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Towards more efficient upconverting materials based on NaYF4 nanoparticles: Phase and size controlled synthesis and optical evaluation

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Upconverting nanomaterials are of vast technological and bio-medical interest, both from the pure scientific research and industrial point of view. Their interest lies on their ability to convert two or more low energy infrared photons into one higher energy photon in the UV-VIS range that can be used for less invasive teranostics and bioassays, more efficient solar cells, IR-activated photocatalytic systems, and so on. The biggest challenge that the scientific community faces for their commercial deployement is to synthesize bright-emitting, phase-consistant and small-sized nanocrystals. Normally these materials are formed of a crystal host in which Lanthanide ions act as substitutional doping within the lattice. To date, the Er3+-Yb3+ codoped β -NaYF4 is the most efficient material known. However, the upconversion phenomenon is a highly complex non-linear optical process and the efficiency depends on several factors such as the nature and crystal structure of the host lattice, the nature and local dispersion of the lanthanides, the synthetic conditions (reagents, solvent, reaction , time and temperature, pH, etc.), and so on. In this context, our study deals with the synthesis and evaluation of up-converting nanoparticles (UCNPs) with formulae Lnx-Yb0.2:NaY0.80-xF4, where x=0.5% for blue-emitting Ln:Tm3+and x=2% for red and green-emitting Ln: Er3+ and Ho3+ systems. Here we report an account of some fundamental research performed in our group that tries to address some of these challenges to afford highly efficient tuneable UCNPs. In particular, we are focusing on the crystalline phase and size, and on the photoluminescent properties of solvo thermal-and microwave-assisted NaYF4 based-nanomaterials.

Biography

Fabrizio Guzzetta has completed his Bachelor in Science at the University of Palermo (Italy) in 2005, and his Master's degree from University of Florida in 2013. Currently, he is pursuing his PhD at the Universitat Jaume I (Spain) under the supervision of Dr. Beatriz Julian-López.

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