# TAILORING THE LUMINESCENCE AND PHOTOCATALYTIC PROPERTIES OF NITROGEN DOPED TITANIA NANOCRYSTALS

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Surface-modification with organic molecules is a powerful tool for manipulating the fundamental optical and photoelectrochemical properties of metal oxide nanocrystals (NCs). In this work a novel method for the controllable modification of the optical band gap, kind of trapping states generated and carriers recombination rate is presented. Using nitrogen/ oxygen organic ligands named formamide (FA) and polyethylene glycol (PEG) under different reaction conditions we tailor the luminescence properties of the $TiO_2$ NCs from controlled wavelength light emitting to visible light photocatalyst. The interaction between PEG and TiO2 forms deep electronic states associated to C-C and C-O bonds which facilitate blue and green wavelength emissions. FA acts as both capping ligand and nitriding agent yielding shallow and deep trapping states endowed it with visible emission at higher wavelength. We showed that the capping ligands used in our research, not only facilitate the formation of nanocrystals with high specific surface area but can also efficiently tailor their optoelectronic properties converting $TiO_2$ in a green- and blue- or red- light emitting material. Efficient photoluminescence was observed with adsorbing specific capping ligands on the surface of the $TiO_2$ NCs which is attractive for white light emission among other applications.

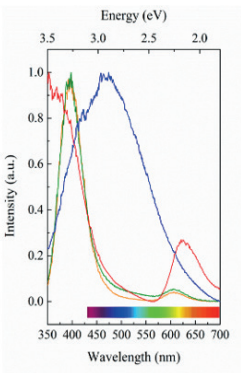


Figure. PL spectra of capped $TiO_2$ NCs (FA-$T_{500}$, red line and PEG-$T_{500}$, blue line) and N- capped $TiO_2$ NCs (FA-T-$U_{150}$, orange line and PEG-T-$U_{150}$, green line)

The analysis of the PL revealed that the enhanced emission in the ligand capped NCs is most likely due to defects and traps created by the organic bonds. These materials can be easily tuned and converted in efficient visible light-harvesting photocatalyst, showing a low radiative recombination of excitons, by a soft, low energy consumption and one-step clean-doping process with organic ligands.

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