NÉEL INSTITUTE Grenoble

Topic for Master 2 internship – Academic year 2019-2020

Synthesis and optical characterization of garnet-type materials with persistent luminescence properties

General Scope:
Persistent luminescent materials display an optical property whereby visible luminescent emission continues from seconds to hours after their optical excitation has stopped. Although the phenomenon of persistent luminescence has been known to mankind for over a thousand of years, the burst in research interest in such materials is quite new. The research and industry interest in such materials is important because of their wide range of applications: *in vivo* imaging (Figure 1.a), security signs and clothings, dials and displays, night vision surveillance, luminous paint, etc. Moreover, synthesizing persistent luminescent nanocrystals would extend their applications, particularly in the biological field.

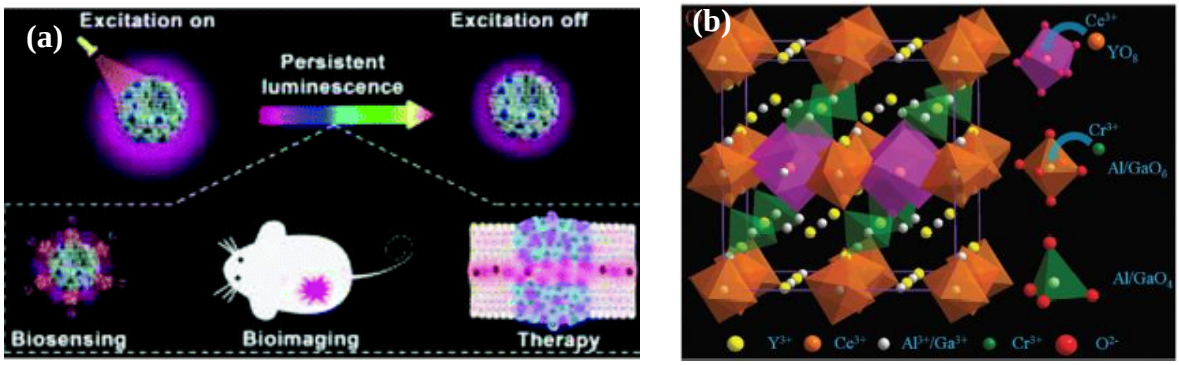

Figure 1: (a) Example of application in bio-imaging for persistent luminescent materials [*Nanoscale*, vol. 9, no. 19, pp. 6204–6218, 2017], (b) Unit-cell structure of YAGG crystal

Research topic and facilities available:
The purpose of this internship is to synthesize persistent luminescent garnets $M_3M'_5O_{12}$ (M = Y, Gd, Sc…, M' = Al, Ga …) micropowders via solid-state at high temperature treatments (>1000°C). The first steps should focus on the synthesis of the most promising garnet compositions (see structure shown Figure 1.b) for persistent luminescence through their doping with d or rare-earth elements. Then, these typical solid-state syntheses of microcrystals will be adapted to the preparation of nanocrystals via solvothermal synthesis in autoclave, coupling solution growths under moderate pressures and temperatures (few hundreds of bars and °C). The structure and the optical properties of the synthesized materials will be also characterized via different techniques such as X-Ray Diffraction (XRD), Scanning Electron Microscopy (SEM), Photoluminescence (PL) measurements.

Possible collaboration and networking:
Institut Lumière Matière (Lyon) & INRS-EMT (Varennes, Québec, Canada)

Possible extension as a PhD: Possible, subject to funding

Required skills:
The candidate should show strong interest in experimental materials science (chemistry and physics)

Starting date: February 2020

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