MASTER DE CHIMIE DE PARIS CENTRE - M2S2
Proposition de stage 2019-2020
Internship Proposal 2019-2020

Parcours type(s) / *Specialty(ies) :*

□ Chimie Analytique, Physique et Théorique / *Analytical, Physical and Theoretical Chemistry* :
☑ Chimie Moléculaire / *Molecular Chemistry* :
□ Chimie et Sciences Du Vivant / *Chemistry and Life Sciences* :
☑ Chimie des Matériaux / *Materials Chemistry:*
□ Ingénierie Chimique / *Chemical Engineering:*

Laboratoire d'accueil / *Host Institution*

Intitulés / *Name* : Institut Parisien de Chimie Moléculaire (IPCM)
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Equipe d'accueil / *Hosting Team :*

Adresse / *Address :* Equipe ERMMES, Campus Pierre et Marie Curie, 33-43, 5ème étage
Responsable équipe / *Team leader* : Pr. R. Lescouëzec
Site Web / *Web site : http://ipcm.fr/article79.html*
Responsable du stage (encadrant) / *Direct Supervisor : Benoit Fleury*
Fonction / *Position : MdC*
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Période de stage / *Internship period* * : 03.02.2019 – 06.07.2019

Hybrid semiconducting nanocrystals for optical treatment of information

* min. 5 mois à partir du 13 janv 2020 / *min. 5 months not earlier than January, 13th 2020.*
Fin de stage au plus tard le 15/07/2020 ou le 30/09/2020 (dates de validation de diplôme). / *End of internship at the latest July 15, 2020 or Sept. 30, 2020 (dates of graduation).*

1. Project

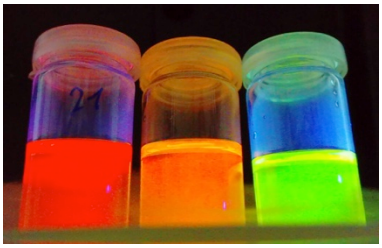
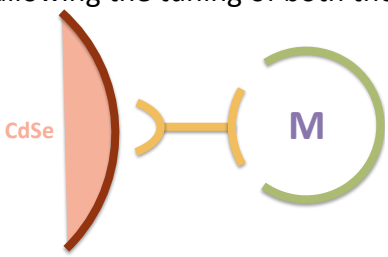


Figure 1 : QDs of different sizes under UV light

We decorate CdSe nanocrystals (quantum dots, QDs) by coordination complexes. These nanocrystals can be excited between 400nm and 800 nm, so as to create an exciton that relaxes in a radiative manner at a specific wavelength according to the size of the particles (figure 1).

When CdSe QDs are doped by Mn(II) ions, this exciton can magnetically couple to the localized spins of Mn(II) ions leading to spontaneous magnetization under irradiation.[1] This phenomenon is known as magnetic polaron.[2,3]

Instead of doping QDs, their surface is decorated by coordination complexes according to figure 2, allowing the tuning of both the choice and quantity of introduced paramagnetic ions.



Component	Role
CdSe Nanocrystal core	Exciton source
Bridging Ligand	Anchoring the metal to the QD, exciton delocalisation, QD-M coupling
Transition Metal	paramagnetism, variety
Outside Ligand	Metal coordination, dispersibility of the system

Figure 2 : expected hybrid nanostructured

The intern should thus:

- ☑**synthesize CdSe nanocrystals**,
- ☑**synthesize various coordination complexes,**
- ☑**graft these** complexes on CdSe nanoparticles
- ☑**characterize each synthetic step**

The aims of the internship are:

- ☑The study of the **influence of the bridging ligand** on the exciton delocalization
- ☑The **control of the surface functionalization** by complexes
- ☑The evaluation of the grafting rates
- ☑**Observing (or not!) light-triggered magnetization of the hybrids.**

2. Methods

UV-Vis et FTIR, luminescence (quantum yields); TEM, ICP, maybe XPS and X-ray fluorescence, EPR, photo-physics experiments (in collaboration)

3. References

[1] R. Beaulac *et al.*, *Science*, **2009**, 325, 973

[2] S. Takeyama, *Magnetic polarons in diluted magnetic semiconductors*, in *Magneto-optics*, S.Sugano, N. Kojima (Eds), Springer, Berlin, **2000**

[3] J. Stöhr, H.C. Siegmann, *Magnetism from fundamentals to nanoscale dynamics*, Springer, Berlin, **2006**