STAGE M2 CHimie Inorganique, Physique et du Solide (*CHIPS*)
2021/2022

- Dates du stage envisagées :

  1er février 2022 - 13 juillet 2022

- Gratification du stage
  X oui ☐ non

- Organisme d'accueil (SIRET, SIREN,…) et représentant légal de l'organisme d'accueil (signataire de la convention) :

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SIRET : 197 819 444 00013
Représenté par : Alain BUI
En qualité de : Président

- Laboratoire d'accueil : ILV, UVSQ, Versailles.

Responsables (tuteurs) de stage :

Responsable : Olivier Oms (olivier.oms@uvsq.fr). Tel : 01 39 15 43 68

Co-responsable : Davy-Louis Versace (versace@icmpe.cnrs.fr), Institut de Chimie et des Matériaux Paris Est, UMR 7182; Rachel Meallet-Renault, Institut des Sciences Moléculaires d'Orsay, UMR 8214. (rachel.meallet-renault@universite-paris-saclay.fr),

- Sujet de stage proposé (1 page maximum):

Combining molecular oxides and bioactives organic molecules for antibacterial applications

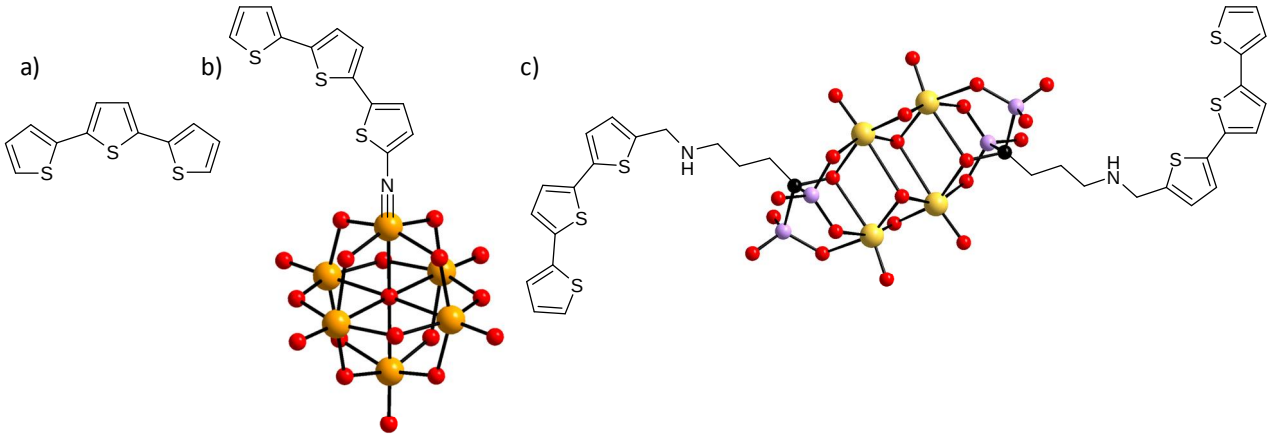
The antibacterial activity of purely inorganic polyoxometalates (POMs), which can be described as molecular oxides incorporating early transition metals in high oxidation states (typically W^{VI}, Mo^{VI} or V^{V}), has been evidenced by Tajima and coll. in the nineties.[1] Following his seminal works, intense research activities have allowed to proved the high potential of POMs as new antibacterial agents. One of the most successful synthetic strategies to obtain highly active POM species is to associate biologically active organic species and inorganic POMs – with the aim to combine their therapeutic effects or even to afford synergistic effects. For example, we have shown in 2019 that the grafting of bisphosphonate ligands on polyoxovanadates can lead to POM hybrids highly active against both gram-positive and gram-negative bacteria. Moreover, a crucial advantage of such molecules is that they can be easily further functionalized for targeted purposes.

We thus herein propose to synthesize unprecedented materials combining POMs and terthiophenes (Figure a). Tertiophenes indeed represent not only a class of biocompatible molecules with intrinsic biological properties – including antibacterial activity via the generation of Reactive Oxygen Species (ROS) under irradiation– but also with outstanding electronic – acting in particular as fluorescent probes – and processability – acting as

photoinitiator for the preparation of polymers– properties.[3] The following approach will be adopted:

- Hybrid molecules will be synthesized either by directly grafting tertiophene on POMs (Figure b) or via bisphosphonate ligands (Figure c).
- The obtained molecules will be used for the preparation of polymers via free-radical or cationic photopolymerization.[4]
- The antibacterial properties of the obtained polymers *s* will be investigated in the dark and under irradiation.[4]

The recruited M2 student will therefore have to carry out the synthesis of the POM-tertiophene molecules, their characterization (UV-Vis, NMR, IR, ESI-M spectroscopies), the one-step preparation of the polymers and the study of their antibacterial activity.



[1] For a review on the antibacterial activity of POMs, see A. Bijelic et al., *Chem. Commun.* **2018**, *54*, 1153.
[2] S. Tomane et al., *Nanoscale Adv.*, **2019**, *1*, 3400.
[3] L. Vallan et al., *Polymers* **2021**, *13*, 1977.
[4] P. Sautrot-Ba et al., *Macromolecules* **2020**, *53*, 1129.

- Domaine(s) concerné(s) :

☐	Théorie	X	Matériaux
X	Expérience	X	Polymères
X	Chimie Inorganique	☐	Autres :
☐	Chimie Physique		
☐	Biophysique		

- Confidentialité du stage :

X Non ☐ Oui