PhD position in Artificial Photosynthesis at Univ. Grenoble Alpes, France

SUN-TO-FUELS:
Designing robust and efficient molecular photocathodes for solar fuel production

Host Laboratories: The project will be developed in collaboration between the SolHyCat team (https://www.solhycat.com/) at the LCBM laboratory and the STEP team (https://www.demadrillegroup.com/) at the SyMMES laboratory.

Project description: The production of fuels from sunlight and abundant raw materials such as water and carbon dioxide (CO_2) is a major challenge of the ecological transition, which is currently the subject of intensive research efforts at international level. Among the various technological approaches for the direct conversion of solar energy into chemical energy, dye-sensitized photoelectrochemical cells (DSPECs) offer undeniable advantages: their construction is based on the dye-sensitized solar cell technology (DSSCs), which relies on the use of inexpensive semiconducting oxides that are easily shaped on a large scale. In addition, they can take advantage of recent advances in the field of bio-inspired catalysis for energy, by integrating abundant first raw transition metal complexes to catalyse the reaction of interest (reduction of protons to dihydrogen H_2 or of CO_2 to carbon compounds of interest such as CO, CH_4, HCOOH...). Nevertheless, for this approach to become technologically relevant, it is necessary today to strongly increase the performances and stability of the first examples of DSPECs that recently appeared in the literature.

The project **SUN-TO-FUELS** builds on the complementary expertises and results recently obtained within the SolHyCat and STEP teams to prepare more efficient dye-sensitized photocathodes for the production of solar fuels, with a focus on the photoelectrochemical reduction of CO_2. Molecular engineering of push-pull organic dyes will be exploited to develop original molecules with strong absorption in the visible region that can be coupled to robust cobalt catalysts in aqueous media. Different strategies will be implemented to increase the activity and the operando stability of the system, for example by modifying the nature of the electrode material or the electrolyte-electrode interface. The most efficient photocathodes will eventually be coupled to a photoanode catalysing the oxidation of water in order to evaluate their performances in a relevant tandem photoelectrochemical cell device.

Required skills : Master degree in molecular (organic/inorganic) chemistry. Additional knowledge in electrochemistry and/or surface functionalisation techniques will be appreciated. Candidates should be open-minded and have a high level of scientific curiosity in order to tackle the multidisciplinary and collaborative aspect of the project.

Applications should include a CV, a motivation letter, recommendation letters and Master grade transcripts. They should be sent to:

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Deadline : 15th March 2022