ITI HiFunMat Master Internship Proposal

☐ M 1 ☒ M 2

Solar light driven Fe-based heterogeneous catalysts for the degradation of biorecalcitrant antibiotics in water

Internship supervisor

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Collaboration with a HiFunMat member (*please indicate their name*)	☒ No ☐ Yes :

Student profile looked for

Master program (*more than one box can be ticked)*	☒ Material science and engineering ☒ Chemistry ☐ Physics
Other indications if necessary	

Internship description

Water treatment is a priority health issue that scientists must address. In particular, in hospitals and the care sector, wastewater is polluted by medical products (antibiotics, anti-cancerous, anti-inflammatory or contraceptive drugs). Impact on the world's population health is dramatic at short- and long-term, with eg. higher cancer risks and reduction of the human reproductive capacity, as treatments in place to date are not efficient enough.

In this field of research of prime importance, solar light driven Advanced Oxidation Processes (AOPs) are promising sustainable cost-effective and efficient water treatment technologies. They generate highly active HO_x° radicals at ambient temperature, that react with the pollutants and further with the reaction intermediates to yield full mineralization of pollutants. Along this line, ICPEES lab developed a leadership in the design of (low energy input) solar light driven Fe-based heterogeneous catalysts able to act simultaneously as Fenton-type catalysts and photocatalysts [1].

- **Fe-based Fenton-type catalysts are able to decompose under solar light hydrogen peroxide (H_2O_2), a green oxidant that forms H_2O and O_2 as byproducts.**
- **Photocatalysts are materials able to drive catalytic transformations of molecules using the redox properties developed at the surface of a semiconductor material under solar light for conducting reduction and oxidation reactions.**

Combination of both catalytic functions in one single body is a highly promising way to enhance reaction rates and photonic efficiencies in water treatment. So, the internship will aim at investigating new solar-light driven Fe-based heterogeneous catalysts combining both functions and able to degrade fastly contaminants of emerging concern such as antibiotics in water. The work will concentrate on the design of innovative heterogeneous solar-light driven catalysts and their physico-chemical characterizations, as well as on the evaluation of their catalytic behaviors under solar light.

The internship will be part of ANR- and IdEX-funded projects. It will benefit from the scientific, technical and human resource environment provided by the 'Photocatalysis and Photoconversion' team, and fully equipped with the necessary tools to conduct the research.

1. Appl. Catal. B: Environ. 262 (2020) 118310 ; ACS Appl. Mater. Interfaces, 12(51) (2020) 57025.