Ecole Doctorale - 104

Sciences de la Matière, du Rayonnement et de l'Environnement

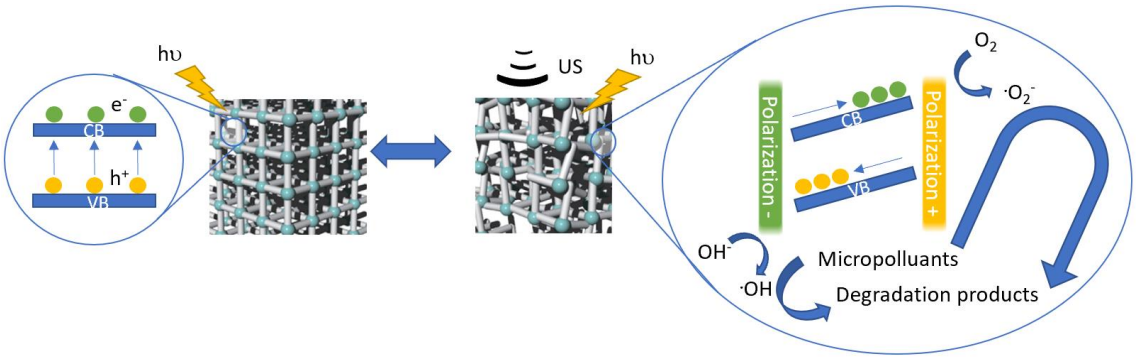
EDSMRE

UCCS UNITÉ DE CATALYSE ET CHIMIE DU SOLIDE

Disordered MOFs and consequences in piezocatalysis

Water pollution is a growing threat to public health, due to its disproportionate location and the discharge of hazardous pollutants by industry and households. Two main approaches are generally studied: 1/ adsorption and 2/ (photo)catalytic oxidation. It is also possible to couple the two approaches by using porous, photocatalytically active materials such as metal-organic structures (MOFs). One of the main limitations of photocatalysis is the rapid recombination of electron-hole (e- h+) pairs, but the application of a piezoelectric potential considerably reduces this recombination, which we have recently demonstrated using borophene (boron nanosheets). A material is said to be piezoactive when its deformation under mechanical stress shifts the center of positive and negative charges within its elementary mesh, spontaneously leading to the generation of an electric field and thus the separation of e- h+ pairs. In the case of MOFs, it was demonstrated in 2021 that they could become piezoactive when defects were introduced into the structure.

The aim of this thesis is to prepare zirconium-based MOFs with a certain level of controlled disorder conducive to the observation of piezoactivity. The disorder of the resulting materials will be characterized indirectly during adsorption of a pressurized gas by XANES and/or EXAFS, as well as directly by AFM (AM-FM), while their piezoactivity will be measured by piezoelectric force microscopy (KPFM and PFM). Promising materials will be evaluated for the degradation of selected micropollutants. In particular, the production of radical species will be determined by trapping and monitored via UV-visible and EPR spectrophotometry.



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Doctoral school: ED 104 SMRE (Specialty – Chemistry of materials)

Additional remarks/comments: Must have a Master in Chemistry, chemical engineering or equivalent.

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