# Appel à Candidature

# Programme Brésil Sciences sans Frontières

## *Nature de la demande :*

☐ *Thèse* ☐ *Cotutelle* ■ *Stage Post Doctoral*

## *Discipline :*

☐ Agronomie ☐ Biochimie ☐ Biologie Générale ☐ Bio Physique

☐ Botanique ■ Chimie ☐ Ecologie

☐ Génétique ☐ Géosciences ☐ Immunologie

☐ Microbiologie ☐ Pharmacologie ☐ Physiologie

## *Intitulé du sujet*

**Synthesis of $TiO_2$-based nanocomposites for the abatement of organic pollutants in a microfluidic photoreactor**

| **Laboratoire d'accueil :** Institut de Chimie des Milieux et Matériaux de Poitiers (IC2MP) | |
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| **Responsable** Nicolas Alonso-Vante, Pr. | **Co-responsable** Aurélien Habrioux, MCF |

## *Description du sujet*

The photocatalytic degradation of organic pollutants via semiconductors' materials has attracted growing interest since the last two decades. Prototypical oxides such as $TiO_2$ have been per se recognized as the candidate for a widespread environmental application because of its long-term stability and its low cost, and interesting surface chemistry. The combined use of photocatalytic and electrochemical processes, i.e., photo-electrocatalysis, represents an efficient method to remove pollutants. The application of an external bias potential between photoanode and cathode allows the promotion of charge separation. Under photons with $E > E_g$, and a sufficient electrical field, electrons leave the $TiO_2$ film/electrolyte interface to the external circuit, allowing the holes in the valence band to react (in a direct or an indirect way) with surface adsorbed species such as organics and/or $H_2O$. The material's synthesis to produce an ideal surface morphology should convey to improve charge separation or reduce recombination of photogenerated electrons-hole pairs. Of paramount importance is to shift the large-gap band gap semiconductor to the visible region of the solar spectrum.

The proposal is aimed at designing thin film electrodes to enhance the transport characteristics in the visible region either by doping or by the use of selected metal nanoparticles in the PEC

system. Furthermore, the project should combine the synthesis of size and shape controlled metal-doped $TiO_2$ nanomaterials with tunable band gaps with the use of reduced graphene oxide (RGO) into the $TiO_2$ film. RGO, with large surface area ~2600 $m^2/g$, must supply more active sites for substrate absorption coupled with an excellent electronic conductivity (π–π conjugated structure). These properties are of interest to inhibit recombination processes of electron-hole pairs. The PEC of synthesized materials will be finally tested at innovative microfluidic photoreactor systems.

The candidate should possess a solid background in materials synthesis and in electrochemistry.

| Signature du porteur du projet | Signature du Directeur de Laboratoire |
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