



# Appel à Candidature

## Programme Brésil

### Sciences sans Frontières



### ☒ *Ecole doctorale Sciences pour l'Environnement - Gay Lussac*

#### Nature de la demande :

*Thèse*

*Cotutelle*

*Stage Post Doctoral*

#### Discipline :

*Agronomie*

*Botanique*

*Génétique*

*Microbiologie*

*Biochimie*

*Biologie Générale*

*Chimie*

*Géosciences*

*Pharmacologie*

*Bio Physique*

*Ecologie*

*Immunologie*

*Physiologie*

**Intitulé du sujet : Gold-based nanomaterials: Correlation between surface plasmon and electrochemical activity...**

#### Laboratoire d'accueil :

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Instituto de Química de São Carlos – IQSC-Universidade de São Paulo.....

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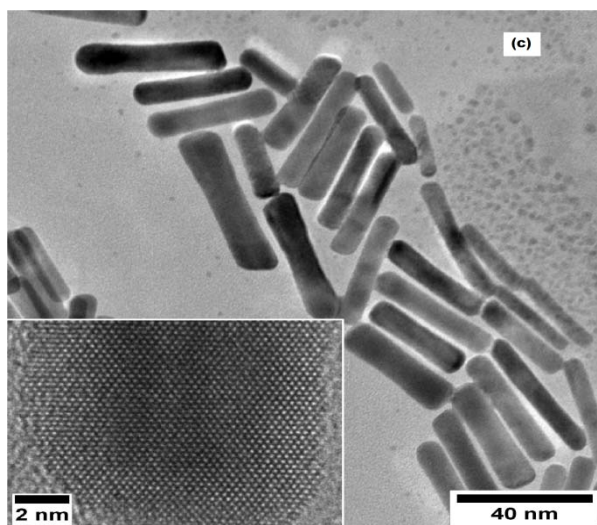
**Description du sujet de thèse** Nowadays, gold is considered as interesting material in wide domains because of its properties when it is at nanoscale. Indeed, gold nanoparticles present unusual properties because of their size, shape and morphology. Therefore their synthesis becomes a challenge since their size and shape determine the potential application [1]. Gold nanoparticles exhibit outstanding optical properties due to their surface plasmon resonance. This phenomenon comes from the interaction between the light and the surface electrons of the nanoparticles. The surface of the particles is a key factor because of its utilization as reaction site and as electron donor or acceptor in electrocatalysis. The affinity of the gold nanoparticles with oxygen permitted to oxidize organic molecules [2]. Recent preliminary results obtained showed that gold nanorods and nanospheres exhibited high electrochemical activity toward glucose oxidation [3]. Usually, this activity is explained by the surface structure of the particles. However, the electronic structure at the surface plays an important role since the surface is the reaction site where electron transfer occurs. Moreover, the correlation between this electrochemical activity and the surface plasmon resonance properties is not well-known.

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The present proposal aims at synthesizing different shape and size controlled gold nanoparticles. Then the core-shell particles (Au-Ag, Au-Cu...) will be considered. TEM will be used to characterize the morphology of the particles. During this thesis, the UV-Vis spectroscopy and surface plasmon resonance will be coupled with electrochemical techniques in order to establish the correlation between the particles surface crystallography, the adsorption phenomenon and their electrochemical activity. Then the real role of the surface electrons in electrochemistry will be relied to the surface plasmon resonance.



- [1] X. Huang and M. A. El-Sayed, *Journal of Advanced Research* 2010, **1 (1)**, 13
- [2] B. Hvolbæk, T. V. W. Janssens, B. S. Clausen, H. Falsig, C. H. Christensen, and J. K. Nørskov, *Nano Today* 2007, **2 (4)**, 14
- [3] S. Hebié, L. Cornu, T. W. Napporn, J. Rousseau, and B. K. Kokoh, *The Journal of Physical Chemistry C* 2013, **117 (19)**, 9872

Signature du porteur du projet

Signature du Directeur de Laboratoire