UMR7647

Elaboration of nanosensors with conjugated polymers for water monitoring

Our environment has been contaminated for decades by increasing amounts of pollutants coming from the industry, intensive farming and other human activities. This led to a cocktail of both chemical and biological waste in natural water whose composition (in terms of identity and concentrations of the pollutants) is actually difficult to determine precisely. In fact, there are no portable and connected devices that are able to monitor water *in situ*.
The goal of this PhD is to design an electronic sensor able to detect *in situ* and simultaneously different chemical species (heavy metals, nitrates, chlorides, and so on).
For that purpose, we are developing the synthesis of sensing elements that are comprised of organic molecules specifically functionalized with chemical entities able to interact with the targeted analytes. These molecules are used in synergy with carbon nanotubes (CNTs) to design nanohybrids, CNT serving as transducing elements in the device thanks to their awesome electronic properties.
An important part of the project is thus the synthesis of innovative molecules. Conjugated polymers are preferred as we have developed in the last years an expertise on the synthesis of such molecules and their use in sensing devices. They are also particularly interesting candidates for the design of nanohybrids with CNTs as they strongly interact electronically with them, thanks to their conjugated system.
Polymers/CNT hybrids will be used to elaborate sensors which will further be electrically characterized in presence of the chemical species. Inkjet printing is the deposition method of the hybrids we have selected as it is viable on an industrial scale and it allows the design of miniaturized and/or flexible devices using plastic substrates.

In addition to the synthesis under a controlled atmosphere and chemical characterization, the candidate will be trained to a large panel of characterization techniques, including optical and electronic microscopies and electrical characterization of electronic devices.

The LPICM laboratory possesses the whole expertise and infrastructure to carry out the project with a chemistry lab, the specific equipment for materials deposition and characterization, and the elaboration of devices. In particular, a test bench specifically designed for the characterization of sensors in water has been set up.

The expected candidate will hold a Master degree in Materials Science, organic synthesis or inorganic chemistry and will show a strong interest in developing a multidisciplinary project.

Contact :

Dr Gaël Zucchi
Ecole polytechnique
LPICM - UMR CNRS 7647
Route de Saclay
91128 Palaiseau (FRANCE)
Tel: +33 (0)1 69 33 43 86
gael.zucchi@polytechnique.edu