# Sensors and biosensors based on organic semiconductors

Racha el Zein, Tuyen Nguyen Duc, Ahmad Keenan, Anne M. Charrier, Jean-Manuel Raimundo.

*Centre Interdisciplinaire de Nanoscience de Marseille, Aix Marseille Université, CNRS, CINaM UMR CNRS 7325, 163 Ave de Luminy case 913, 13288 Marseille cedex 09, France. Fax: +33(0) 491 418 916; Tel: +33(0) 629 413 925*

E-mail: raimundo@cinam.univ-mrs.fr

Nowadays, diagnosis and continuous monitoring of physical, biochemical and chemical variables are of major interest because their possible changes or disruptions may cause adverse effects or even death. Among them, organic and inorganic chemicals control became of crucial importance due to their ubiquity in a wide variety of medical, agricultural and industrial applications. While the wide use of such chemicals has had significant economic and social benefits it has also led to the release of many micro-pollutants into the environment that are harmful even at very low concentration.

Therefore, an increased effort in fast and selective detection methods allowing real-time monitoring of their concentration changes is strongly necessary. For instance, chromatography techniques (high performance liquid chromatography (HPLC), liquid chromatography coupled with spectroscopy (LC-MS), gas chromatography (GC), capillary electrophoresis (CE) etc…) are methods extensively used for the determination of various chemicals disruptors. Although, these methods offer excellent selectivity and detection limits, they are not suitable for rapid processing of multiple samples and real-time detection. They involve highly trained operators, time-consuming detection processes, and complex pre-treatment steps requiring efficient low-cost alternatives.

These concerns have lead to the development of emerging techniques with highly specific features. Thus, the design and fabrication of electrochemical and field effect transistors based sensors are both promising approaches for the future in diagnosis and monitoring. They fulfill the requirements in terms of selectivity, sensitivity, fabrication cost and size, as well as, in term of easiness of use.

In this context, we will present herein the preparation and the sensing properties of highly selective and specific sensors based on organic semiconductors [1].

[1] (a) T. Nguyen Duc, R. El Zein, J.-M. Raimundo, H. Dallaporta, A. M. Charrier, *J. Mater. Chem. B* **1**, 443 (2013); (b) T. Nguyen Duc, A. Labed, R. El Zein, S. Lavandier, F. Bedu, I. Ozerov, H. Dallaporta, J.-M. Raimundo, A. M. Charrier, *Biosensors & Bioelec.* **54**, 571 (2014); (c) JH. Aboubakr, H. Brisset, O. Siri, J.-M. Raimundo, Anal. Chem. **85**, 9968 (2013); (d) T. M. Nguyen, M. Petit, J.-M. Raimundo *Biosensors & Bioelec*., 2015 to be submitted (2015) ; (e) A.M. Charrier, J.M. Raimundo, S. Lavandier, A. Keenan, patent deposited (2015).

**Jean-Manuel RAIMUNDO**
Associate Professor
Centre Interdisciplinaire de Nanoscience de Marseille CINaM
UMR CNRS 7325
Aix Marseille Université
163 avenue de Luminy, case 913
Fax: +33(0) 491 418 916; Tel: +33(0) 629 413 925
jean-manuel.raimundo@univ-amu.fr

## Professional Experience

Sept. 2012-Nov 2013. Invited Researcher at NIMS Tsukuba, Japan
Since Sept. 2007. Associate Prof., Aix-Marseille University, CINaM (Interdisciplinary Center for Nanosciences of Marseille) UMR CNRS 7325 "hetero-pi-conjugated structures for organic molecular electronics and sensors"
Oct. 2002 / Sept. 2007. Assistant Prof., University of Nice Sophia-Antipolis "*Dendritic structures for biological applications*"
Sept. 2001 / Sept. 2002. Post-Doctoral position at Total Fina Elf, "*Elaboration of N and P type pi-conjugated semi-conductors for photovoltaic applications"*
Jan. 2001 / Sept. 2001. ATER (Temporary Assistant Prof), University of Angers "*Synthesis of pi-conjugated systems for field effect transistors applications*"
Nov.1999 / Dec. 2000. Post-Doctoral position at ETH Zurich (Fellowship from ETH) group of Prof. F. Diederich "*Synthesis of polymers and chromophores for 3rd non-linear applications*"
October 1999. PhD, (Fellowship from CNET) Supervisor: Dr Jean Roncali "*Synthesis of chromophores for optoelectronic applications*"

## Fields of Research

organic semiconductors, sensors, biosensors, surface science, environment

## Publications

1. Nguyen Duc T. ; Labed A. ; El Zein R. ; Lavandier S. ; Bedu F. ; Ozerov I. ; Dallaporta H. ; Raimundo J.-M. ; Charrier A.-M. *Biosensors & Biolelec.* (**2014**), 54, 571-577
2. Malytskyi V. ; Simon J.-J. ; Patrone L. ; J.-M. Raimundo. *RSC Advances.* (**2015**). 5, 26308-26315.
3. Nguyen Duc T. ; El Zein R. ; Raimundo J.-M. ; Dallaporta H. ; Charrier A.-M. *J. Mater Chem B*. (**2013**), 1, 443-446
4. Aboubakr H. ; Brisset H. ; Siri O. ; Raimundo J.M., *Anal. Chem.* (**2013**), 85, 9968-9978.
5. Chen Z., O. Siri, J.-M Raimundo. *Chemical Communication* (**2011**), 43, 10410-10412.