



International Doctoral Program in Science Position

Novel architectures for advanced sensing based on 2D materials platforms.

Background and motivation

Among forefront applications of 2D materials such as graphene (GR) and transition metal dichalcogenides (TMDs) the detection of sub-ppm concentrations of small molecules on a background of strongly interfering gas mixtures is currently challenging physics, chemistry and device engineering and requires an in-depth knowledge of molecule-surface interactions at the nanoscale. These materials provide a unique opportunity to discover new sensing layers either through functionalization of single 2D layers or through a combination of 2D layers of different compounds to obtain novel heterostructures.

In this project, platforms based on properly functionalized 2D materials will be developed to produce arrays of miniaturized sensors for applications in the field of volatolomics, i.e. the profiling of VOCs emitted by living organisms, which is taking an increasing importance in various scientific areas such as medicine, as well as food and environmental sciences.

Bridging surface chemistry with device engineering, this project is aimed to develop ultra-sensitive arrays of sensing layers for the detection of biomarkers of lung pathologies in the exhaled breath. Layers characterization will involve photoemission and Raman spectroscopies, along with scanning probe spectro-microscopies. All materials will be functionalized at the nanoscale with selected molecules to make them more selective to specific target molecules. Data analysis with machine learning methods will be used to discriminate potential pathologies through pattern recognition in molecular fingerprint of breath samples.

Profile

- Master's degree or comparable qualification in physics, chemistry, materials science or adjacent fields. The title must be obtained before OCTOBER 31ST 2021.
- A strong interest for multidisciplinary research is required.
- Previous experience in either surface science, micro-spectroscopy, nanomaterials preparation and characterization.
- Good knowledge of the English language, both spoken and written, is essential.
- Strong commitment, ability to work in a team, and eagerness for international mobility is desired.

Opportunities

- Experimental research participating to the international collaboration between Università Cattolica del Sacro Cuore, and KU Leuven with at least one year spent in both institutions.
- **Double PhD degree (UCSC and KU Leuven) opportunity.**

Supervisors

- Prof. Luigi Sangaletti UCSC, Italy e.mail@unicatt.it
- Prof. Steven De Feyter, KU Leuven, Belgium, steven.defeyter@kuleuven.be