Université Lille Nord de France
Pôle de Recherche et d'Enseignement Supérieur

Ecole doctorale régionale Sciences Pour l'Ingénieur
Lille Nord-de-France - 072

Titre Thèse	2D materials-based wearable sensors for healthcare monitoring or 2D materials-based wearable patches for health monitoring	
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Abstract:

The need for better quality and affordable healthcare is one of the greatest challenges faced by our society. Early diagnosis of some diseases has thus become highly important to decrease mortality and to use more adapted therapeutic decisions.

The aim of this thesis project is to develop highly sensitive and selective wearable health monitoring patches, allowing identification of irregularities in the levels of different biomarkers of patients at risk, as well as of patients under treatment. The challenge of sensitive, specific, non-invasive and fast detection of disease biomarkers will be addressed through the integration of graphene and related 2D materials (GRM) based nanostructures and their synergy with aptamers as stable biorecognition ligands onto flexible patches.

This thesis is an inter-disciplinary program across engineering, physical (CARBON Group), chemical and soft matter sciences (Nanobiointerfaces Group), addressing key aspects of a future platform for wearable, flexible and stretchable electronics. Integration of several biosensors into an array for multi-analyte detection and scale-up for manufacturing also need to be demonstrated. Attention will be paid in terms of validation of these health care patches; this will include reproducibility, precision, accuracy, linearity and stability tests and a comparison with current standard methods.

In the first part of this thesis, GRM-FET (FET: Field effect transistors) will be firstly studied and fabricated, based on the expertise of CARBON group (material growth, transfer on adequate substrate, transistor structure, fabrication process, electrical characterization,…).

In the second part, the 2D-materials' functionalization will be carried out and characterized, based on the expertise of NANOBIOINTERFACES group (ligand attachment, prevention of non-specific adsorption, …).

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