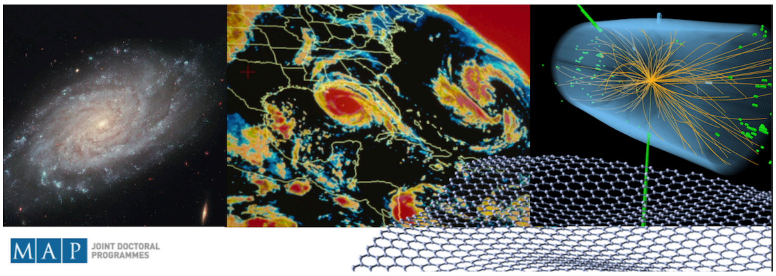

Contribution ID: **133** Type: **Contributed Talk (20 minutes)**

Covalent Organic Framework/Laser-Induced Graphene Hybrid Nanostructured Electrochemical Sensor for Sulfamethoxazole Determination

Friday 11 October 2024 14:30 (20 minutes)

Sulfonamides are a class of synthetic broad spectrum antimicrobial drugs widely used in animal farms and human medicine. Sulfamethoxazole (SMX) is the most prevalent sulfonamide and has been detected in different aquatic environments in concentrations as high as 49.7 µg L-1 [1]. The scientific community and health organizations are increasingly concerned due to the potential toxicity to environmental and human health, as well as due to the increasing awareness towards the spread of antibiotic resistant strains and antibiotic resistance genes [2], [3]. Therefore, there is a need for more effective monitoring tools. Electrochemical sensors are interesting substitutes for traditional analytical methods owing to their dimensions, ease of operation, and cost-effectiveness [4]. However, to sense low concentrations in complex matrices, several aspects must be addressed, such as transducer performance, response time, reproducibility, sensitivity, and selectivity [5]. Herein, laser-induced graphene (LIG) [6] transducing surfaces integrated with covalent organic frameworks (COFs) as selective recognition moieties are proposed to fulfil the required needs for low-concentration electrochemical sensing. LIG surfaces were fabricated through direct laser irradiation of polyimide substrates, i.e. direct laser writing [6]. The produced surfaces were extensively characterized, allowing their optimization for the intended sensing application. Thereafter, the in situ growth of a COF based on 1,3,5-tris(4-aminophenyl)benzene (TAPB) and 2,5 dimethoxyterephthalaldehyde (DMTP) linkers [7] on LIG surfaces was studied. The morphological, structural, and chemical characterization through Raman spectroscopy and scanning electron microscopy indicated the successful formation of COF particles on the LIG surface. Subsequently, the electrochemical characterization of the modified electrodes, with the support of a typical redox probe, revealed that the COF layer does not limit the electrochemical response of the LIG electrodes. Cyclic voltammetry was also employed to assess the electrochemical behaviour of SMX towards the COF/LIG modified electrodes. The cyclic voltammograms showed the presence of an SMX oxidation peak with no corresponding reduction peak, which also evidenced the irreversibility of the electrochemical reaction. All in all, this constitutes a promising result regarding the application of the COF/LIG hybrid nanostructure as sensing platform for sulfamethoxazole in water environments.

Which topic best fits your talk?

Condensed Matter Physics and Nanomaterials

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Session Classification: Nanomaterials, Optics & Photonics (Chair: Ariel Gurreiro, Universidade do Porto) - Anf. Física (13.1.19)