MEON Seminar Slot

27th November 22, 2024, 15h00, CENIMAT, Leopoldo Guimarães Auditorium

Title: Development of conductive inks and memristive active material for printed electronic applications

Abstract

The Internet of Things (IoT) and Industry 4.0 have significantly impacted the development of sensors and smart devices, emphasizing the importance of power efficiency and affordable production. Memristors, a two-terminal device that displays varying conductance levels in response to a specific electrical signal, are promising options for long-term and short-term memory. Printed electronics have opened new avenues for low-temperature, low-cost processes for material processing and manufacturing. To obtain environmentally friendly functional inks for printed electronic applications pertaining to memristors, two distinct classes of inks were developed: conductive ink and functional ink for the memristor's active layer. Carbon allotropes were chosen for the conductive ink due to their good electrical, mechanical, and thermal properties. Graphene was selected as the conductive fille, achieving sheet resistance lower than 100 Ω/sq and a gauge factor up to 4. Conductive inks were used as sensors in electronic applications, specifically as a sensing layer in an 8 x 8-inch capacitive sensor with a signal to noise ratio of 10 or as humidity sensors. Indium gallium-zinc oxide (IGZO) was selected for the functional inks due to its attractive resistive switching characteristics. The devices exhibit both volatile and non-volatile switching at operating voltages below 5V, enabling testing on various 4-bit pulse sequences. Lastly, this work advanced the field of printable memristors and sustainable conductive inks for electronic applications.

Speaker – Miguel Franco

Graduated in Micro and Nanotechnologies Engineering from NOVA School of Sciences and Technologies in 2016. Between 2020 and 2024, he took a PhD in Materials Engineering at Minho University under the supervision of Prof. Senentxu Lanceros-Mendez and Dr. Asal Kiazadeh in the field of printed electronics. Under the scope of his PhD, it generated six publications as the first author; one of them consisted of the fabrication of an inkjet-printed IGZO memristor. Additionally, during his PhD, he collaborated with BCMaterials, namely on the European project ICT-02-2018: Flexible and Wearable Electronics, fabricating a large array of sensors: thermal, piezoresistive, and humidity sensors. Currently, he joined CEMIMAT|i3N to work on the FOXES project. Since 2017, he has been working on environmentally friendly ink formulations tuned for specific printing techniques, with a focus on sustainable materials for use on electronic devices and printing techniques from 2D materials to metal oxides.