Institute of Microelectronics of Barcelona IMB-CNM CSIC

The **IMB-CNM** is the largest institute in Spain dedicated to the research and development of Micro and Nano Technologies and Microsystems and with unique capabilities in silicon technology. It belongs to CSIC since its foundation in 1985 and is distinguished as a María de Maeztu Unit of Excellence.

IMB-CNM aims to contribute to the advancement of knowledge and to the economic and social development of society, as well as to the training of researchers and engineers and to the advice to public and private entities.

The research activities of IMB-CNM are dedicated to Micro/Nano Integrated Systems: miniaturized electronic systems which include sensing and/or actuating capabilities in addition to electronic information processing, power management and external interfaces.

The IMB-CNM is located on the Autonomous University of Barcelona (UAB) Campus and contains the largest clean room facilities in Spain with full capability to process its own CMOS technologies and laboratories.

Project Type: TFG/TFM

Project Title: Impedance Spectroscopy of Polymeric-Based MIM Structures for Memristive Applications.

Research Group: MicroEnergy Sources and Sensor Integration Group (MESSI)

Project Description:

- This project aims to perform an in-depth electrical characterization of MIM structures based on polymeric films fabricated using printed technologies, with potential applications as memristive devices. This work will involve current-voltage (I–V) measurements as well as the extraction and analysis of Impedance Spectra (IS) at different stages: pristine states, post-electrical breakdown (electroforming), and, if memristive properties are exhibited, the different resistive states and transitions that govern this behavior: High Resistance State (HRS), Low resistance State (LRS) and SET (transition from HRS to LRS) and RESET (transition from LRS to HRS) processes.
- The student will become familiar with the necessary equipment for these studies, such as a Semiconductor Parameter Analyzer, Impedance Analyzer, Probe Station, and methods for addressing the challenges associated with low-current AC measurements.
- Based on the obtained data, the student will construct and analyse the IS (Cole-Cole diagrams, which plot -Im(Z) as a function of Re(Z)) as well as Bode diagrams. Using a circuit model, capacitance will also be analyzed to assess the memcapacitance properties of the devices from capacitance-voltage (C-V) curves.

Work Plan:

- The initial tests and analyses will be carried out on hafnia-based memristors, whose electrical and memristive properties are well known and in which the group has extensive expertise. This stage aims to gain intuition in the analysis and modeling of IS.
- At a more advanced stage, the student will continue with the characterization of the printed polymer-based MIM structures, which the MESSI group has recently begun to investigate in collaboration with the Integrated Circuits and Systems (ICAS) group at IMB-CNM, a team with long-standing expertise in printed technologies.

Carrer dels Til·lers s.n., Campus UAB | 08193, Cerdanyola del Vallès
https://www.imb-cnm.csic.es | talent@imb-cnm.csic.es
+34 93 594 7700

- Finally, based on the gained experience with this technique, the student will analyse the possible key factors underlying the observed electrical trends, such as surface roughness, composition, structural defects, and conductive elements of these devices.

Candidate desired studies:

- ✓ MSc in Semiconductor Engineering and Microelectronic Design
- ✓ MSc in Nanoscience and Nanotechnology
- ✓ MSc in Telecommunications Engineering
- ✓ Double Bachelor's Degree in Physics and Chemistry
- ✓ BSc in Nanoscience and Nanotechnology

Application Process:

Before applying, please **check with your TFG/TFM program supervisor,** as he/she may already be coordinating with us to assign the project.

If there is no such coordination**, complete this form and send your CV and a motivation letter** to **Talent@imb-cnm.csic.es**, with the **subject: "TFG/TFM at IMB-CNM"**

Your CV will be forwarded to the Researcher leading the project who will contact you directly if interested.

Check our website for more information about the IMB-CNM and our research activities

https://www.imb-cnm.csic.es/en

Take the next step in your research career with us!

*By applying, you accept our data protection policy.

**IMB-CNM (CSIC) adheres to the European Charter and Code of Conduct for Researchers, ensuring full alignment with their principles and requirements, including equal opportunity, transparency, merit and ability, caring for an open, fair, and excellence-based hiring processes.

IMB-CNM holds the HR Excellence in Research award, which acknowledges CSIC's commitment to continuous improvement in HR strategies for researchers.

Carrer dels Til·lers s.n., Campus UAB | 08193, Cerdanyola del Vallès
https://www.imb-cnm.csic.es | talent@imb-cnm.csic.es
+34 93 594 7700