

CONTRATOS PREDOCTORALES 2020 SEVERO OCHOA

PROJECT TITLE / JOB POSITION TITLE:

Ferroelectric HfO₂ thin films with enhanced properties by doping and interfaces engineering

RESEARCH PROJECT / RESEARCH GROUP DESCRIPTION: (2.000 characters – including spaces)

The recent discovery of ferroelectricity in doped HfO₂ has been a breakthrough in the quest for non-volatile memories. Most of the research on ferroelectric HfO₂ has been focused on polycrystalline films. Epitaxial films of HfO₂, scarcely investigated, can help to better understand the ferroelectric properties and prototype devices, particularly those involving thickness of a few nanometers and/or lateral dimensions of a few tens of nanometers. After our group at ICMAB reported recently the epitaxial stabilization of the ferroelectric phase in Hf_{0.5}Zr_{0.5}O₂ films grown by pulsed laser deposition on La_{0.67}Sr_{0.33}MnO₃ electrodes, we have made important progress in understanding the growth and properties of epitaxial HfO₂, including a map of the growth window, demonstration of epitaxial stress engineering, integration with Si(001), fabrication of ferroelectric tunnel junctions, and achievement of high polarization, endurance, and retention in sub-5 nm films.

These results have confirmed that epitaxial films are a versatile platform to investigate the properties of ferroelectric HfO₂. This PhD Thesis Project, focused on epitaxial films, aims to better understand the ferroelectric properties of HfO₂ and improve endurance without degradation of polarization and retention. For this goal, two strategies will be followed: 1) Control by a chemical composition, and 2) Control by interface engineering developing epitaxial nanolaminates. The films will be grown by pulsed laser deposition, on perovskite oxide substrates and Si(001), and the thesis will involve exhaustive structural (X-ray diffraction, atomic force microscopy, etc.) and electrical characterization (polarization loops, endurance, retention, leakage, etc.) of the ferroelectric HfO₂ films.

The PhD student will join the Materials Science Institute of Barcelona (ICMAB-CSIC), www.icmab.es. The host research group, formed by researchers and students from different countries, investigates actively epitaxial growth and properties of ferroelectric thin films. The thesis will be supervised by Dr. Florencio Sanchez:

<https://scholar.google.es/citations?hl=es&user=DSHxiTkAAAAJ>

JOB POSITION DESCRIPTION:

(2.000 characters – including spaces)

Include all the relevant information about the position, role, responsibilities and skills required within the project/group

We are looking for a highly motivated candidate. He/she should have recently obtained a master's degree (in physics, chemistry, nanoscience, material science or related) with outstanding grades.

Good communication skills and fluency in English is required.

The PhD thesis will involve experimental work in materials synthesis and characterization, including both structural and functional properties, especially ferroelectric properties.

The PhD student will work in close collaboration with other PhD students and senior scientists, and the PhD project will involve international collaborations.

PhD students that recently defended their thesis in similar topic (ferroelectric oxide films) under supervision of Dr. F. Sánchez published more than 10 scientific papers, most of them as first authors, in high impact journals.

GROUP LEADER:

Dr. Florencio Sánchez

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