CONTRATOS PREDOCTORALES 2022 SEVERO OCHOA

PROJECT TITLE / JOB POSITION TITLE:

Wrinkling and strain patterning in free-standing ferroelectric membranes

JOB POSITION RESEARCH LINE:

RL, General.- FUNCTIONAL OR MULTIFUNCTIONAL NANOSTRUCTURED MATERIALS

RESEARCH PROJECT / RESEARCH GROUP DESCRIPTION:

This project focuses on nanoscale wrinkling phenomena in free-standing oxide ferroelectric membranes. Although wrinkles in 2D membranes made of ductile materials, such as metals and organics, have been used in a wide spectrum of applications ranging from microfluidics, optical devices, smart windows, adhesion or wettability, extension of this strategy to oxides is not obvious owing to their brittle character. However, the discovery a facile route to fabricate oxide ultrathin free-standing membranes has opened the door to a radically new landscape, particularly in ferroelectrics. Ferroelectrics exhibit spontaneous polarization that can be switched between two or more energetically equivalent orientations (domains) by external fields. The coupling between strain, electrostatics and wall mobility in such surface-dominated materials, offers an amazing playground for engineering nanodevices with special interest in nanoelectronics and energy. Counterintuitively, ferroelectric membranes exhibit remarkable elasticity which results from the couplings referred to above, allowing membranes to wrinkle similarly to ductile materials. Since domains and domain walls constitute elemental building blocks in ferroelectric electronic devices, wrinkling in these materials offer a radically new platform for tailoring self-organized functional nanostructures. The present proposal focuses on structural and electronic aspects of the coupling between ferroelectric domains and wrinkling, using state-of-the-art atomic resolution transmission electron imaging and spectroscopy.

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JOB POSITION DESCRIPTION:

By accepting this position, you will join a multidisciplinary, multicultural and international team, which includes membrane preparation, functional characterization with local probes (Raman spectroscopy, PiezoForceMicroscopy, Conducting-AtomicForceMicroscopy, Kelvin-probe, etc), and advanced structural and spectroscopic analysis using state-of-the-art transmission electron microscopy. This is an extensive team which works on a radical collaborative basis. Thus, communication and group work skills are highly valued.

In a first stage you will participate in the preparation of the membranes by PulsedLaserDeposition, and their basic characterization by XRayDiffraction, and Scanning and transmission electron microscopy. The precise focus of the work is defined through successive feedback with collaborators investigating the functional properties of the materials.

The local atomic and electronic structures will be investigated by aberration-corrected scanning-transmission electron microscopy imaging and electron energy loss spectroscopy. These are intensive techniques and you will have the support from experienced collaborators.

For more details, don't hesitate to contact the project leader at the address indicated below.

GROUP LEADER:

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Research project / Research Group website: PID2019-108573GB-C21&2
https://icmab.es
https://icn2.cat/en/oxide-nanophysics-group

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