

Predoctoral open position in “Unravelling the Nucleation and Growth of High-Temperature Superconductors through Correlated, Time-Resolved In-Situ X-ray Diffraction and Absorption Spectroscopy at ALBA synchrotron”

We offer a position for a predoctoral contract (*Ayudas predoctorales PREX*) in the framework of the forthcoming NEXT-HTS project “Next-Generation High Temperature Superconducting Coated Conductors: From Ultrafast Growth to Disruptive Devices” (PID2025-170440OB-I00) from the “*PROYECTOS DE GENERACIÓN DE CONOCIMIENTO Y FORMACIÓN DE PERSONAL INVESTIGADOR PREDOCTORAL, Convocatoria 2025*” funded by the Spanish Ministry of Science, Innovation and Universities (cofounded by European Union).

Main tasks:

The project aims to engage talent young students for a doctorate in the field of **High Temperature Superconductors** (HTS) by investigating the mechanisms of their nucleation and growth by **Transient Liquid Assisted Growth (TLAG) method** as well as their resulting superconducting performance, a promising ultrafast growth process developed in our group with significant potential for industrial application. Its development was initiated through an ERC Advanced Grant.

We perform ***in-situ* X-Ray Diffraction (XRD), X-Ray Absorption Spectroscopy (XAS) and Grazing-Incidence Small-Angle X-Ray Scattering (GISAXS)** time-resolved and correlated experiments at two of the ALBA synchrotron beamlines, NCD-SWEET and CLAESS, that are complemented by *ex-situ* experiments, done at **The Energy Transition CSIC-ALBA Joint Laboratory (ETJL)**.

The main activity during this pre-doctoral research will be settled at the **ALBA synchrotron’s ETJL** and selected beamlines during the beamtime campaigns. The post-nucleation and post-growth characterization includes the following techniques: Optical Microscopy (OM), Atomic Force Microscopy (AFM), Scanning Electron Microscopy (SEM), X-ray Diffraction (XRD), superconducting properties (SQUID) as well as Transmission Electron Microscopy (TEM) and Transport measurements (PPMS) in collaboration with other members of the group. The data analysis will be mainly performed with **python and MATLAB** programs developed in our group.

As part of the **InCAEM project**, the candidate will also have access to ***in-situ* Raman spectroscopy** (ALBA synchrotron site) to investigate the oxygenation of as-grown films. Oxygen incorporation is essential for developing the superconducting phase and controlling the charge-carrier density, yet the mechanisms governing this process remain incompletely understood. Combining these experiments with synchrotron-based characterization will provide an opportunity to investigate the relationships between film growth, oxygen incorporation and the development of superconducting properties

Requirements:

- Degree in Physics, Chemistry, Materials Sciences, Engineering or similar.
- High motivation in experimental research.
- Working aptitudes in a collaborative group.
- High level of written/spoken English.
- Academic grades and research experience will be considered in the evaluation.
- Any experience and knowledge in superconductivity synchrotron radiation, X-Ray Diffraction, X-Ray Absorption Spectroscopy, Raman Spectroscopy, instrumentation and/or automatization of equipment, program development (Python, MATLAB) or large data management will be very valuable.

We Offer:

Full time-contract

Length: 4 years

Salary: Gross annual salary in accordance with the CSIC salary policy for a PhD student.

How to apply:

The selection process will be continuous until a good candidate is found.

Qualified female applicants are explicitly encouraged to apply.

ICMAB is an equal opportunity employer committed to diversity and inclusion of people with disabilities.

Interested persons should send an email to hr_suman@icmab.es attaching:

- CV
- Academic grades certificates of BSc and MSc
- Letter of motivation
- Reference letter
- Contact details of a second reference person.

About SUMAN group and ICMAB:

The candidate will join the **Superconducting Materials and Functional Nanoengineered Structures Group (SUMAN)** (<https://suman.icmab.es/>), a large, international and interdisciplinary research group with over 30 years of experience in high-temperature superconducting (HTS) materials. Its research focuses on understanding the physical mechanisms governing **superconductivity** and advancing these materials towards technological applications, supported by extensive international collaborations with research institutions and industry.

High-temperature superconductors can carry very high electrical currents with negligible resistive losses, at liquid nitrogen temperatures and under high magnetic fields. Their potential applications include high-power cables, fusion, wind generators, electrical aviation, accelerators and ultra-high-field nuclear magnetic resonance systems. The development of HTS tapes, known as coated conductors, is advancing these technologies, with compact fusion currently driving significant growth in the field. The ICMAB-SUMAN group actively contributes to these developments through collaborative research projects. Particularly relevant to this PhD is its collaboration with the neighboring **ALBA Synchrotron**, within the **Energy Transition CSIC-ALBA Joint Laboratory (ETJL)**.

ICMAB-CSIC, with over 250 researchers from 47 nationalities, is a four decades old research institute located at the **Universitat Autònoma de Barcelona (UAB) campus**, surrounded by other research and technological centers and with access to many state-of-the art equipment and scientific facilities. Moreover, ICMAB-CSIC has its own scientific services equipped with the newest scientific instrumentation and with highly specialized technical staff available to the scientific community. ICMAB-CSIC stands out for its great training activity at the doctoral level. **Training on technical, scientific and transversal skills** are offered to ICMAB-CSIC personnel. Moreover, ICMAB-CSIC has coordinated 2 Marie Skłodowska-Curie COFUND doctoral training programs on advanced functional materials: DOCFAM (2017-2022) and DOCFAM+ (2023-2028).