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European Research Council

ICMAB
INSTITUT DE CIÈNCIA DE MATERIALS DE BARCELONA
EXCELENCIA SEVERO OCHOA
CSIC
CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS

SUPERCONDUCTING MATERIALS and large scale nanostructures Department

INSTITUT DE CIENCIA DE MATERIALS DE BARCELONA-ICMAB-CSIC

http://departments.icmab.es/suman/

PhD student call offer entitled: Ultrafast growth and performances of high temperature superconducting layers

In the framework of an Advanced ERC European grant (**ERC-2014-ADG ULTRASUPERTAPE**) we are offering three doctoral (PhD) student positions (3 years of duration, each one) in:

- Experimental material science involving solution chemistry, clean-room environment, ultrafast growth experimental furnaces and advanced characterization tools.
- Physical properties involving experimental work on angular electrical transport measurements at high field and low temperatures, SQUID and Hall magnetometry, vortex dynamics. This will involve lithography techniques and work in clean room facilities.
- Aberration-corrected transmission electron microscopy studies involving measurement of local structural distortions around defects and interfaces and associated effects on electronic structure.

ICMAB offers excellent conditions for PhD students, including:

- a creative, world-class interdisciplinary research environment for fundamental and applied nanoscience state-of-the-art infrastructure for the preparation and characterization of nanostructured materials.
- a highly regarded scientific education.
- a strong international nanoscience network.
- broad knowledge on superconductivity and superconducting materials

RESEARCH PROJECT

The project aims at achieving low cost / high throughput / high performance High Temperature Superconducting tapes using an unprecedented approach based on a novel transient liquid assisted growth process. Superconductivity is a macroscopic quantum phenomenon that enables some materials to carry large currents without dissipation below

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a certain critical temperature and magnetic field. Since high temperature superconducting materials were discovered 30 years ago, many potential applications emerged by the fact that these materials could reach the superconducting state at the moderate cost of liquid nitrogen temperatures. Nowadays, the international community is able to fabricate high temperature superconducting tapes addressing large scale applications in the energy sector (generation and distribution), transportation and large magnets (magnetic resonance, fusion, particle accelerators). The main challenge is that the cost/performance ratio is stilll too high, so new technologies have to be developed to decrease this ratio. The breakthrough of the project is to explore an ultrafast growth process using solution chemistry (100 times faster than existing technology) to reach thick superconducting layers able to carry large currents and generate ultrahigh magnetic fields. For those purposes an integrated platform based on additive manufacturing and digital printing able to address a competitive manufacturing process using solution chemistry is being developed and combinatorial chemistry will be used for fast screening. Ultrahigh tapes performances should be achieved by incorporating nanoparticles in the layers using colloidal solutions and controlling the strain and electronic state of the ultimate superconducting layers achieved. Special attention will be devoted to study the superconducting properties and vortex pinning mechanism, correlating them with the microstructure. High resolution transmission electron microscopy will be used for evaluating the microstructure and understand the growth process. The big challenge is to obtain micron-thick layers keeping their integrity after deposition, ensuring epitaxial growth and high performances. Experiments at Synchrotrons and High Magnetic Field installations are carried out.

This is an interdisciplinary project where material science, physics and chemistry need to be compiled. The research team is therefore composed of backgrounds of these different disciplines. We are seeking for physicists, chemists or materials scientists to integrate in the very international existing research team.

REQUIREMENTS and VALUABLE MERITS

- Bachelor in physics, chemistry, chemistry engineering, materials science or materials engineering and a master in any of the above degrees.
- A high level of English. All working meeting are held in English
- High motivation to experimental research.
- Working aptitudes in a collaborative group.

We invite applications from excellent candidates anywhere in the world. Apply sending CV, academic grades certificate and reference letters to:

erc-ultrasupertape@icmab.es

The recruitment process will be closed when a suitable candidate is found.

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