PhD OPPORTUNITIES within
Nanoparticles and Nanocomposites GROUP

http://www.icmab.es/nn

Engineering Bacterial Cellulose Nanocomposites
(E-BCN, MAT2015-64442-R)

Supervisors: Anna Laromaine and Anna Roig

Cellulose constitutes an almost inexhaustible biopolymer, being the most abundant renewable natural polysaccharide produced in the biosphere. Cellulose, with a complex hierarchical and chiral structure, and more recently nanocellulose, is being actively revisited when designing new functional (bio)nanocomposites. Although cellulose is predominantly obtained from plants, it can also be synthesized by bacteria, algae and fungi. In particular, bacterial cellulose (BC) produced by microbia has the same molecular formula as vegetal cellulose but in contrast is a purer biopolymer that exhibits a higher degree of polymerization and better crystallinity. BC also presents high porosity, transparency and an extraordinary water holding capacity. Moreover, a very unique characteristic of BC is the possibility to impact on its micro(nano)structuration and shape during its production. Thus, the biosynthesis of cellulose offers to materials scientists a model biopolymer to study structure, topography and new bottom up approaches to fabricate nanocomposites. **The PhD thesis will have as the main goal to develop novel bacterial cellulose nanocomposites by i) topographically structuring BC films during biosynthesis and by ii) creating nanocomposites with inorganic nanocrystals and biomolecules on its fibers.**

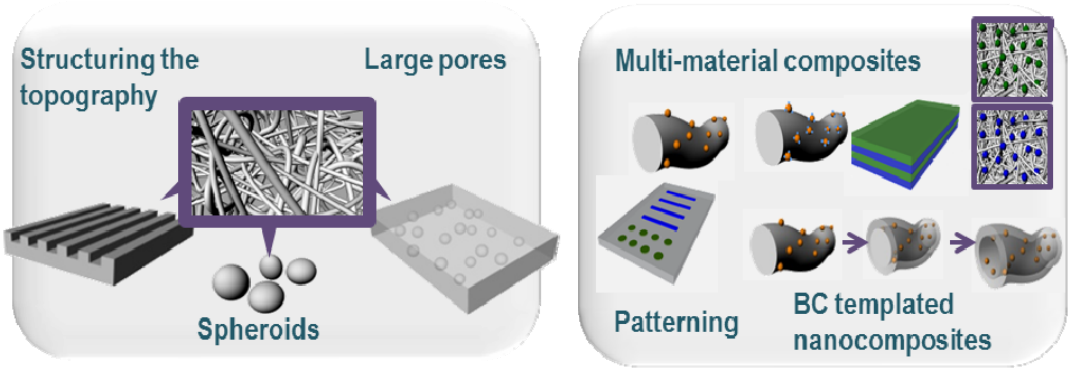


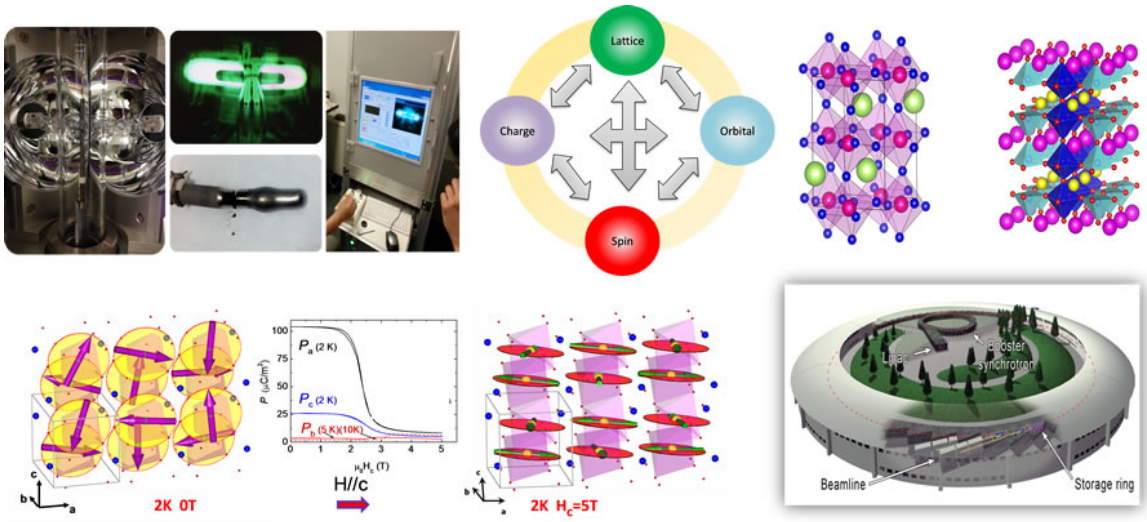
Figure. Schematic representation of some of the targeted materials

The PhD candidate will work in a challenging project from the materials/nanotechnology point of view and he/she will learn various synthetic methods (BC biosynthesis, nanoparticles synthetic routes, atomic layer deposition, surface patterning) as well as a whole array of characterization techniques related to materials science. **The desired profile is of a nanoscience and nanotechnology or chemistry graduate with strong interest in nanomaterials.**

Investigation of new phenomena in novel multiferroics

Supervisors: Dr. Martí Gich and Prof. José Luis García (http://departments.icmab.es/cmeos)

The recent discovery of a new class of materials (type-II multiferroics) in which the magnetic and electric properties are strongly coupled is attracting very much interest because of the possibility to manipulate magnetism by electric fields and vice-versa, to magnetically control ferroelectric states. Along with its technological functionalities, multiferroics are also of great interest in fundamental research into strongly correlated oxides and quantum matter. **This thesis project aims to synthesize, fabricate and characterize novel multiferroics and magnetoelectric transition metal oxides in the form of single crystals, thin films or powders.** New crystal preparation facilities (based on optical furnaces) recently implemented at ICMAB will be used in addition to more classical methods of preparation (solid state reaction, PLD,..). **Another key objective of this project is to characterize the structural, charge and magnetic orders responsible for the electric and ferroelectric responses of these oxides under different external conditions.** Besides learning the conventional techniques for macroscopic characterization, the student will be extensively trained in the use of synchrotron and neutron diffraction and other related techniques in the best european sources (ILL, ALBA, ESRF, PSI, DIAMOND, ..). Our group is pioneer in applying new crystallographic methods of data analysis to tackle the original magnetic and structural orders that govern the interesting properties of this new class of materials. These advanced experiments and analysis methods will permit the student to achieve the objective of identifying new microscopic mechanisms producing fascinating magnetoelectric and exotic magnetic phases in these frustrated oxides.



This PhD project is offered to graduates in chemistry, physics, nanoscience and nanotechnology or geology.

Functionalized bacterial cellulose for skin tissue regeneration

Supervisors: Dr. Anna Laromaine and Dr. Anna Roig

Skin tissue engineering aims at mimicking the epidermal layer of around 0.1-0.2 mm by providing an elastic support to grow keratinocytes, a similar porosity and attachment to the dermis and the capacity to promote vascularization. Commonly, collagen extracted from porcine and non-woven poly-lactic acid scaffolds are used in the engineering of the epidermis. However they present drawbacks , such as safety and neovascularization issues, contraction of the material and response to external stimuli, such humidity. The use of porous scaffolds contributes to the neovascularization an allows incorporating a combination of proteins such as fibroblast growth factor and proteins which mimic the basement membrane. Bacterial cellulose (BC) is a pure biocompatible biopolymer which does not contain lignin and hemicelluloses, two non-degradable components and potential source of toxicity present in plant cellulose. BC can be fabricated as films of different porosities and transparency in the UV-NIR. BC has high water holding capacity, flexibility and conformability.

This PhD thesis will investigate the potential of bacterial cellulose in skin tissue regeneration where the incorporation of other components (nanoparticles and proteins) to the BC scaffolds will increase the BC functionalities. More specific objectives of the PhD thesis are: i) demonstrating the in-growth of keratinocytes and fibroblasts cells within the BC scaffold, ii) evaluating of functionalized BC with inorganic nanoparticles and proteins and iii) performing skin regeneration studies. Student will work in a highly interdisciplinary project and he/she will learn characterization techniques of scaffolds, cell culture techniques and other related aspects. Student will work closely to biological labs to demonstrate skin regeneration. **The desired profile is of a biochemist, biologist, nanotechnologist or chemistry graduate with strong interest on the bio-related applications of materials.**

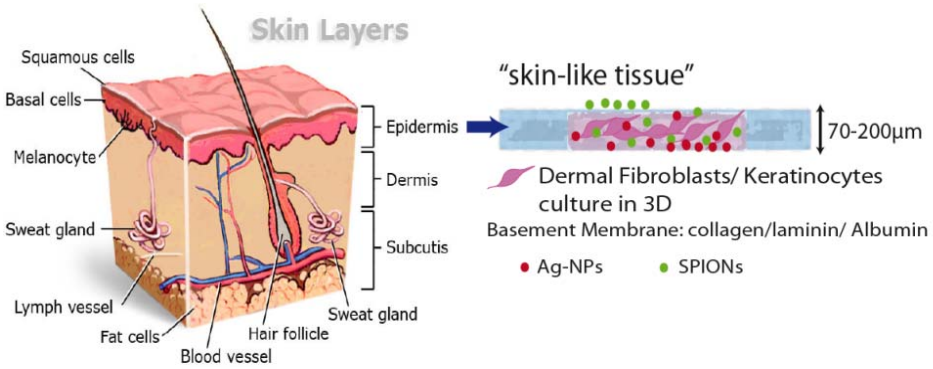


Figure. Schematic representation of the dermis and intended BC skin regeneration scaffold.

Eligibility

- **Candidates should be ready to enter an official doctoral programme in September 2016** (under Spanish Law). By this time, they must have obtained a university degree and a master degree; or must hold an official university qualification from a country of the European Higher Education Area with a minimum of 300 ECTS of official university studies, of which at least 60 are at masters' level.
- Candidates must have a **strong commitment to scientific research** and an excellent academic record (desirable above 8 in a scale of 10).
- Candidates must have **good working knowledge of English**.
- MINECO fellowship candidates may not have held a **PhD contract exceeding 12 months by June 2016**

How to APPLY

DEADLINE: March 31st 2016

Documentation required

- Personal data and CV
- Covering letter, including motivation for applying
- A copy of your Certified Academic Record, showing grades obtained (degree and masters). If these are not in Catalan, Spanish or English, applicants should attach an official translation in one of these languages
- Two letters of recommendation from lecturers or researchers with whom you have studied or worked and who can judge your potential as a PhD student. Only letters with official letterhead and signature will be accepted. Please be sure to inform your referees that their letters must be uploaded in the online application tool before deadline to provide the following information in the application form:

Application Form http://icmab.es/jobs/2468-phd2016#apply

Read more on http://icmab.es/jobs/2468-phd2016

If you have further questions, or if there are particular issues regarding your application, please contact: roig@icmab.es, mgich@icmab.es, or alaromaine@icmab.es