

PhD position at the SyMMES and LMGP laboratories at Grenoble - France

Development of bioactive metal oxide surfaces for the formation of beneficial marine biofilms

Project description

Marine biofouling—the buildup of organisms on ship hulls and marine infrastructures—causes major ecological and economic impacts by increasing fuel use, emissions, and maintenance costs, while promoting invasive species that disrupt ecosystems. It begins with organic molecule adsorption, followed by microbial colonization forming biofilms that anchor larger species such as algae, mussels, and barnacles.

Current antifouling solutions show numerous drawbacks. Toxic biocidal coatings have been banned, and “fouling-release” alternatives remain costly and only partly effective. An emerging eco-friendly strategy promotes beneficial microorganisms forming “positive biofilms” that naturally inhibit harmful species. The BioMIFoul project aims at developing and characterizing bioactive metal oxide surfaces that mimic marine materials and attract protective bacteria. For that purpose, metal oxide thin films will be functionalized with marine adhesive proteins shown to strongly bind diverse substrates. By precisely controlling oxide and protein properties, we aim to optimize protein adsorption and bacterial adhesion. Interactions between metal oxide surfaces, proteins and bacteria will be studied using real-time, label-free surface plasmon resonance (SPRi) imaging.

This PhD project comprises the following tasks:

- the production and purification of recombinant adhesive proteins;
- the optimisation of the fabrication of SPR biochips coated with various metal oxides;
- conducting SPRi experiments to investigate (i) the interactions between different surfaces and proteins, and subsequently (ii) the interactions between surfaces functionalised by these proteins and marine bacteria.

This project will be carried out jointly by the LMGP and SyMMES laboratories (joint supervision).

The combination of materials science, protein engineering and microbiology will enable a detailed study of the interactions between metal oxide surfaces, proteins and marine bacteria, with a view to gaining a better understanding of these as yet poorly understood phenomena and inspiring innovative solutions to combat marine biofouling.

The PhD will start on the 1st of december 2026.

Research profile & skills (required / highly desirable):

The candidate, who will have completed a five-year post-A-level degree (Master's, engineering degree) in 2026, must have a solid theoretical and practical background in biochemistry, biophysics and/or microbiology. They should be keen on multidisciplinary approaches, able to work as part of a team and possess excellent writing and communication skills (reports, presentations, etc.). They must have a good knowledge of at least one of the languages used in the host laboratories: French or English.

Scientific environment:

The Material and Physical Engineering laboratory (LMGP) (www.lmgp.grenoble-inp.fr/en) at Grenoble has an international reputation in the fields of nanomaterials and structured thin film materials and their applications in different fields, among which biology and biomedical engineering. LMGP has outstanding material characterization capacities that are routinely operated (SEM, TEM, Xray diffraction, ellipsometry, XPS, IR and Raman spectroscopy etc). The Engineering of NANomaterials, BIOMolecules and Surfaces (NaBioS) team have a long-standing expertise in investigating protein adsorption and aggregation phenomena at interfaces using real-time surface-sensitive techniques (SPR, QCM, IR) and microscopy and developing custom-made molecular tools and screening assays.

The Molecular systems and nanomaterials for energy and health (SyMMES) laboratory (www.symmest.fr/en) at CEA Grenoble aims at developing basic research on themes with strong societal issue: zero-carbon energy, information and communications technology (ICT), biotechnology and human health. To do this, the SyMMES explores the design, synthesis and study of architectures and innovative and original functional materials, guarantees of the relevance of future research proposals from the laboratory. The laboratory is also interested in the reactivity and properties of biomolecules, providing a novel approach to biological questions. The Chemistry for the Recognition and Study of Biological Assemblies (CREAB) team has recognized expertise in biosensor/biochip/electronic nose development in view of applications in the field of health technologies, environment, etc.

Salary: Pay scale of a fixed term post as a Grenoble-INP PhD student (gross salary of approx. 1800 €/month)

Application procedure:

Please send motivation letter, CV and recommendation letters to:

Charlotte Vendrely charlotte.vendrely@grenoble-inp.fr and **Yanxia Hou-Broutin** yanxia.hou-broutin@cea.fr

Closing date for applications: September 15, 2026