

## *Optimising MOCVD growth of Oxides ZnO Nanostructures for solar photon conversion*

This subject is only for Argentinean candidates (Erasmus Mundus Action 2: Arcoiris).  
Web page: <http://www.arcoiris.polito.it/>

The purpose of this thesis project is the growth optimization of ZnO nanostructures with respect to their solar photon conversion and their implementation in energy devices by pulsed injection metal organic chemical vapor deposition (PI-MOCVD). First evaluations will lead to the selection of the more interesting precursor among Zinc acetate, zinc acetylacetone, Zinc  $\beta$  dicetonate or Diethyl zinc ( $Zn(C_2H_5)_2$ ). The candidate will focus on the growth parameters suitable for nanowire and/or nanofilm fabrication of ZnO on different substrates including Si-wafers and sapphire. The influence of different parameters (temperature, pulse injection, flow rates ...) on the growth rate and on the growing regimes will be investigated and correlated with structural properties of the nanostructures. A special attention will be paid to the study of the first stages of the nanostructure's growth through ex-situ characterizations (transmission electron microscopy, X-ray reflectometry) as well as in situ substrate curvature measurements that can be modified by stress in the nanostructure (due by example to lattice mismatch between the substrate and the film).

Once the growth optimization of ZnO nanostructures is achieved at the laboratory reactor different synchrotron X ray based techniques will be implemented on an MOCVD reactor implemented at SOLEIL synchrotron radiation facilities with the aim of determining, in situ, in real time, the surface/gas interaction, the structural properties (strain, composition, size, faceting, ...) of the nucleus/islands/nanowire as well as the growth kinetics and growth mechanism.

### **Scientific environment**

The LMGP is part of MINATEC site, which is a center of excellence for Nanotechnologies, located at Grenoble, in the heart of an exceptional scientific environment. LMGP (along with its associated engineering High School of Physics, Electronics & Materials (PHELMA)) belong to Grenoble Institute of Technology.

Research at LMGP is dedicated to material sciences and focuses on studies related to intrinsic properties of materials, their structure and the processing of crystals or thin films, for applications in the fields of Information Technologies, Energy or Health.

The laboratory is composed of 40 staff members, 50 PhDs or Post-docs and is structured in 4 research groups.  
<http://www.lmgp.grenoble-inp.fr>

### **Required Skills :**

The applicant must have a Master Degree or equivalent Engineering degree in Materials Science or Physics. This PhD work offers training on solid state physics through the study of ZnO nanostructures. It involves a large spectrum of experimental techniques devoted to physical and structural characterization. A Master Degree in Material Science and/or Solid State Physics (Microelectronic Thin films) is ideally required.

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### **Subsistence allowance**

For the duration of your mobility period (34 month) you will receive the following monthly subsistence allowance: **Doctorate** 1,500 euro.

### **Travel costs and insurance**

Your travel costs will be covered within the total limit of 2,000 – 2,500 euro. The ARCOIRIS consortium provides a full insurance coverage (health, travel, accident) to all grant holders participating in the individual mobility activities.