# Post-Doctoral position (LMGP, 2011-2012, 1 year)

## Growth, annealing and doping mechanisms of nanostructured oxide thin films used as transparent conductors for photovoltaic applications

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Key words: polycrystalline thin films, n- and p-doping, annealing process, growth modelling.

Transparent conductive oxide (TCO) thin films have received in the last decade increasing interest due to their potential use in solar cells of second and third generation as electrodes in the front side. The use of highly-doped wide band-gap semiconductor is usually required to reach a very high transparency as well as a strong conductivity. Up to now, a wide number of oxide materials have been identified as promising such as indium tin oxide (ITO), fluorine-doped tin oxide (FTO) or zinc oxide (ZnO). The two latter are good candidates with a wide band-gap at 300 K and a highly potential but complex doping with aluminium, chlorine or fluorine atoms. The growth of oxide films in its polycrystalline variant is necessary due to the requirements of very large dimensions and performed by spray pyrolysis (i.e. chemical vapour deposition). Such a growth results in the formation of a highly-disordered and randomly-oriented grain structure with a large density of extended defects such as dislocations and grain boundaries.

The first aspect of the work will be devoted to the optimization of the growth processes in order to control the grain morphology and size as well as their crystallographic orientation. Thermal treatments with appropriate conditions will be investigated so as to induce a beneficial structural re-ordering. A better understanding of the correlation between the polycrystalline structure and the doping properties is also expected. The use of a wide number of structural and optical characterization methods will be carried out such as scanning and transmission electron microscopy imaging, x-ray and electron diffraction techniques, secondary ion mass spectroscopy or luminescence measurements.

The second aspect of the work will be dedicated to the fabrication of composite materials as transparent conductors, which consist of a metallic nanowire network within a matrix of oxide grains. At last, better transparency and conductivity are expected and can be investigated by UV–visible spectrophotometry, four-probe resistivity and Hall effect measurements.

The work will be done in collaboration with CEA-LITEN within a common project funded by the Carnot Institute “Energies du Futur”.

**Applicant background:**

The applicant should have a PhD in materials science and engineering or materials physics including a good background in semiconductor and solid state physics + physical-chemistry characterization

methods. A first experience in material growth will be essential. The applicant should be able to work independently, have a very good English level and exhibit human skills to work within a motivated team of technicians and researchers.

**Application:**

Please send a resume + motivation letter + references to the e-mail addresses below.

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