

2020-2021 Internship proposal at LMGP Lab.

Development of transparent conductive oxides (TCOs) for integration in invisible electronic devices

Abstract

In the hot topic of the development of transparent electronics, the main bottleneck is represented by the lack of performant p-type transparent semiconductors, preventing the conception of see-through electronics. The internship will be focused on the synthesis of these exotic materials and their integration in transparent electronic devices.

Project description

P-type TCOs are challenging to be synthesized since their elevated ionic aspect, as the large electronegativity of the oxygen leads to a strongly localized valence band edge, resulting in reduced holes' mobility and conductivity. Furthermore, the development of a p-type based transparent electronic is restricted by material availability and cost, for these reasons Cu based oxides arise as the most promising compounds, with Cu₂O the leader compound in research.

Although, its low energy gap does not allow its integrability in fully transparent devices. The insertion of a trivalent cation in this crystal lattice was proved to be able to increase optical and electrical performances, resulting in a Cu-based delafossite structure with general chemical formula Cu⁺M³⁺O₂.

The project will be based on the **synthesis of CuCrO₂ thin films by AA-MOCVD (Aerosol assisted Metal-Organic Chemical Vapor Deposition)**, with a special interest in films out of stoichiometry and their characterization (X-ray diffraction, scanning and transmission electron microscopy, energy and wavelength-dispersive X-ray microanalysis, and Raman spectroscopy). Transparent p-n junction devices will be subsequently fabricated by depositing CuCrO₂ thin films on well-known n-type layers such as ZnO thin films and ZnO nanowire, and their optical and electrical properties will be analyzed.

Scientific environment:

The candidate will work within the LMGP, Materials, and Physical Engineering Laboratory, in the FUNSURF group (Functional thin films and surface nanoengineering).

Located in the heart of an exceptional scientific environment, the LMGP offers the applicant a rewarding place to work.

LMGP Web Site: <http://www.lmgp.grenoble-inp.fr/>

Profile & requested skills:

The ideal candidate is a highly motivated engineering school and/or Master student with knowledge in physics, nanotechnologies or material science. Aptitude for teamwork, good spoken and written English will be appreciated.

Subject could be continued with a PhD thesis: YES

Allowance: Internship allowance will be provided (approx. 600 euros/month)

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