2023-2024 Internship proposal at LMGP and IMEP-LAHC Lab.

Advanced nanocomposite materials as transparent and flexible P type semiconductor coatings

Abstract

For the development of new efficient P type TCO thin films as key step toward transparent electronic, the internship focuses on the development of a p-type oxide nanocomposite material for flexible and transparent electronics.

Context

Transparent conductive materials (TCMs), derived from highly doped semiconductor materials, are widely used as electrodes in many applications (flat screens, touch screens, solar cells...). At present, however, the best electrical characteristics are obtained for compounds with n-type conduction, while those with p-type conduction have much lower conductivities and mobilities, especially for integration on thermally sensitive and flexible substrates. This mismatch has several consequences: (i) it hinders the development of transparent hole-conducting thin films and (ii) it hinders the realisation of p-n junctions or transistors that take advantage of the transparent semiconducting properties, whereas this would open the way to many applications in different fields

In this context, in order to break the bottleneck of transparent p-type semiconductor layers for applications on thermally sensitive and/or flexible substrates, the internship aims at developing an innovative material concept based on the realization of a nanocomposite associating a thin-film matrix of a transparent p-type semiconductor oxide based on copper 1+ oxide with a nanonet, a network of randomly oriented nanowires, of p-type semiconductor Cu_2O, so as to increase the performance in terms of figure of merit

Project description

The master's internship will focus on two experimental aspects with, at the beginning, the participation in the elaboration work of nanonets and nanocomposites. Then, the work will mainly aim at fully characterizing the electrical behaviour of the Cu_2O nanonets by correlating the results to the synthesis method used and at analyzing the contribution in terms of properties induced by the realization of the nanocomposite as a function, for example, of the deposition thickness of the matrix in thin layer. During this internship, it will also be interesting to study the mechanism of charge transport, probably by percolation, in these new compounds. For this purpose, the internship will rely on the morphological and structural characterization means of LMGP (SEM, AFM, XRD, Raman,...) and on the numerous electrical characterizations available at IMEP in the neighbouring building on Minatec.

Scientific environment:

The candidate will work in the LMGP, Materials and Physical Engineering Laboratory, in the Fun Surf team in close collaboration with IMEP-LAHC, a specialist in characterisation and electrical properties of semiconductors.
Located in the heart of an exceptional scientific environment, LMGP and IMEP-LAHC offer the candidate a rewarding place to work. LMGP and IMEP-LAHC website: http://www.lmgp.grenoble-inp.fr/ et https://imep-lahc.grenoble-inp.fr/

Profile & requested skills:

The candidate is a high school, engineering school and / or Master student whose training focuses primarily on materials science. Aptitude for teamwork, good spoken and written English will be appreciated. We are looking for dynamic students, motivated.

Internship allowance: Internship allowance will be provided.

CONTACT **Jean-Luc Deschanvres, :** : jean-luc.deschanvres@grenoble-inp.fr; Tel: 04 56 52 93 34

Frederique Ducroquet : frederique.ducroquet@grenoble-inp.fr Tel 04 56 52 95 24