

Proposition de thèse

Le sujet

Intitulé du sujet

Realization of electrode / organic semiconductor contact by doping for printed plastic electronics

Mots-clés

Organic electronics; contact resistances; organic semiconductor; molecular alignment; doping

Champ scientifique principal

Physique

Champs scientifiques secondaires

Matériaux ; électronique

Description du sujet

Organic electronics is a branch of electronics using organic material with electrical, optical and mechanical characteristics useful to the development of a large number of applications: flexible screens, photovoltaics, sensors, etc. These applications use electronic devices such as OLEDs, solar cells (OPV) or transistors (OTFT). The economic interest is obvious, but limits remain which prevent the development of such of applications.

In organic electronic devices, the charge injection at the contact electrode / organic semiconductor (OSC) is crucial and is often limited. This limitation is due to the specific charge injection mechanisms at the contact electrode/OSC. The contact is characterized by the presence of a contact resistance. The consequences on the devices performance are huge: operating frequency limitations, drifts, instabilities on so on. The presence of a non-negligible contact resistance is particularly problematic in OTFTs and is considered as one of the most important technological bottleneck to overcome for the development of OTFT-based applications.

During the PhD we propose to make a new type of electrode / OSC contact overcoming the problems of the contact resistance. To reach this goal, we will make an OSC -doped / OSC junction at the contact and we will oriented the molecules of the semiconductor. The contact created will be continuous without potential barrier.

The candidate will work alternately between the laboratories of Strasbourg and Reims during periods of 12 or 18 months. Round trips will be expected during these periods.

The collaboration between the Charles Sadron Institute (University of Strasbourg), which develops techniques for producing aligned and doped OSCs with very high conductivity, and the Laboratoire de Recherche en Nanosciences (University of Reims), which develops advanced characterization techniques for organic transistors , should make it possible to achieve the objective of developing stable electrode / OSC interfaces free of contact resistance.

L'établissement d'accueil

Nom de l'établissement d'accueil

Université de Reims Champagne Ardenne

Présentation de l'établissement et du laboratoire d'accueil

The PhD will take place in the Laboratoire de Recherche en Nanosciences of the University of Reims Champagne Ardenne and in the Institut Charles Sadron of the University of Strasbourg.

Laboratoire de Recherche en Nanosciences of the University of Reims

Research activities in the Laboratoire de Recherche en Nanosciences (LRN) are focusing on nanotechnologies and biotechnologies, and are following 3 main axes:

- nano-materials and applications (mainly organic electronics and nanowire growth)
- nano-characterizations, development of new methodologies (based on numerous AFMs, KPFM...)
- nano-bio-technologies (mainly based on QDs and their applications)

LRN is involved in a number of collaborative French and European research projects.

The group involved in the present project is focusing on organic electronics, and in particular in organic transistors characterization and modelling.

Institut Charles Sadron

Located in Cronenbourg, the Institut Charles Sadron (ICS) is a “Unity propre” (UPR 22) of the CNRS, associated with the Institute of Chemistry (INC) of the CNRS, in close interaction with the Institute of Physics (INP) and the Institute of Sciences of engineering and systems (INSIS). It is also associated with the University of Strasbourg and INSA Strasbourg, with strong links to the Physics and Engineering UFR, the ECPM and the Faculty of Chemistry. The ICS is a key player in the Carnot Mica Institute and in the Federation of the Materials and Nanosciences Research of the Grand Est, and is involved in numerous national and international networks.

The research activity of the SYCOMMOR group is focused on the processing-structure-property nexus of functional (macro)molecular systems used for instance in plastic electronics. The fundamental questions tackled in the group concern the understanding of morphogenesis and structure-formation mechanisms in functional macro(molecular) systems and their impact on material's properties (electronic, opto-electronic, rheological, thermoelectric). Structural control is achieved by chemical engineering based on self-assembly and physico-chemical methods such as physical gelation, aerogel fabrication by supercritical CO₂ extraction, epitaxy and high-T rubbing. Materials of interest include functional organogelators, semi-conducting polymers, pi-conjugated self-assembled systems as well as their associations in so-called “hybrid” materials.

Our research activity is based on the group's expertise in chemical engineering, morphological/structural analysis by TEM, neutron scattering and material's property testing (UV-vis and FTIR spectroscopy, charge transport and thermoelectric properties, (piezo)rheology).

Candidat

Profil du candidat

Degree allowing enrolment for a PhD (such as Master 2 de Recherche or equivalent) in physics, materials science, Nanoscience or closely related science.

The candidate should be attracted by experiments.

During the thesis, the candidate will be involve in the fabrication of the polymer-based devices and the exploitation of the experimental setups to characterize the structural properties and the electrical properties of the polymer films.

English spoken and written is mandatory.

Modalités de candidature

Documents à fournir

A detailed Curriculum Vitae;

A copy of your official academic degrees (Master 1 and Master 2) and the corresponding transcripts.

Contact(s)

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