PhD Thesis Project

NIR-absorbing dye-sensitized solar cells: Ultrafast Spectroscopy of the primary charge generation processes

Institut de Physique et Chimie des Matériaux Strasbourg

Dye-sensitized solar cells (DSSCs) were invented by Prof. M. Grätzel more than 25 years ago. They form today the basic framework for the very popular since highly efficient, easy-to-fabricate, but rapidly degrading perovskite solar cells. A new development was recently launched with DSSCs, namely a version that would use only the near-IR part of the spectrum and thus be transparent and colorless. These would find a tremendous range of applications as cheap films on large area windows. Prototypes developed by French scientists exist, protected by patents, but the power conversion efficiency needs to be improved. The French ANR therefore funds a fundamental research projects associating four collaborating teams of chemists and physicists.

The group of Prof. S. Haacke at IPCMS – University of Strasbourg/CNRS develops and applies femtosecond spectroscopy for the study of biomolecules and organic molecules for energy conversion. Ultrafast femtosecond UV/VIS spectroscopy allows to « watch » the charge transfer and other molecular processes in real time. We investigate these processes in new promising organic molecules using laser spectroscopy with $<30 \times 10^{-15}$ s resolution. Indeed, our present results obtained in on-going PhD projects show that charge separation can occur on these time scales, but charges recombine also very quickly and are then lost for power generation. This calls for a new molecular design, a better control of the molecular organisation, and solar cell design.

The PhD project requires skills and qualifications in laser spectroscopy and molecular physics, which will be complemented by training provided in

1. Femtosecond laser spectroscopy (transient absorption and fluorescence spectroscopy), interpretation of spectro-temporal data, quantitative data analysis.
2. An up-to-date knowledge of the relevant literature, reporting on project progress, publication in papers and international conferences, supervision of undergraduate students, project management.

The PhD position is open from October 2018, and has a 3-years duration. The net salary is approx. 1600€/month. This collaborative project is funded for four years, and involves partners in Amiens, Paris and Nantes. We seek for an excellent student with a Master degree in Physics or Physical Chemistry and good ability to teamwork. Applications including a CV and a letter of recommendation must be sent to

Pr. Stefan Haacke  
Stefan.haacke@ipcms.u-strasbg.fr  
+33 3 88 10 71 71  
http://www.ipcms.unistra.fr/?page_id=16853