

Workshop on Lifetime and Stability of Hybrid and Organic Devices

UPMC, April 21-22 2016, Paris

The workshop on Lifetime and Stability of Hybrid and Organic Devices was hosted by the University Pierre and Marie Curie in the brand new center of conference of the campus and co-organized by the University of Southern Denmark. The workshop was sponsored by the Institut Français du Danemark and Sorbonne Universités through Séminaires Internationaux de Recherche.

Bertrand Meyer, Vice-president of the University Pierre and Marie Curie in charge of Research and Innovation welcomed all the participants on the renovated campus of Jussieu. He reminded the audience on the decision taken at the Cop21 in Paris in keeping the rise in temperature below 2°C, and that this goal only can be achieved by a global development of alternative energy productions such as from organic and hybrid solar cells.



Morten Madsen, credit E. Garcia UPMC

After this short introduction, Morten Madsen, Associate Professor at the NanoSYD Center (University of Southern Denmark) and coordinator of the Initial Training Network THINFACE presented the network, its general objectives and network events such as the next summerschool on Nano-organics and devices that will be held in Paris 4-8 July. (<http://summerschool16.sciencesconf.org/>)

The scientific session on organic systems started with Dr. Tom Aernouts, group leader of the Thin Films Photovoltaics Team at IMEC (Leuven). Dr. Aernouts gave a motivating introduction to the topic by presenting stress testing on organic systems: air stability, light stability and heat stability. The dominant failure mechanisms were then presented, giving to the audience the first basic principles related to the degradation of OPV.



Tom Aernouts, credit E. Garcia UPMC



Christoph J. Brabec, credit E. Garcia UPMC

Prof. Christoph J. Brabec, head of the Institute Materials for Electronics and Energy Technology (I-MEET) at the University Friedrich-Alexander-Universität Erlangen-Nürnberg gave an excellent talk on the identification of the structural factors that can accelerate the degradation. Prof. Brabec also proposed several original material designs to improve the stability of the devices.

The session on organic systems highlighted then the research work of two junior researchers Dr. Vida Engmann, post-doc at the NanoSYD center (University of Southern



Vida Engmann (left) Sylvain Chambon (right) credit E. Garcia UPMC

Denmark) and Dr. Sylvain Chambon, CNRS Researcher in Laboratoire de l'Intégration du Matériau au Système (Bordeaux). Dr. Engmann explained to the participants how additives can stabilize the performance of organic devices and Dr. Chambon focused on the degradation of oxide layers (TiO_2 and MoO_3) in organic devices upon light and thermal stresses and alternative materials to improve the stability of

the devices where proposed.

The first day of the workshop ended with a cocktail organized at the 24th floor of the Zamansky tower at UPMC, offering to the participants the best view of Paris.



Paris from Zamansky tower. credit Kitmacher UPMC

The morning of the second day focused on hybrid perovskite solar cell, the emerging new type of hybrid solar cell technology that already reaches efficiency around 20%.



Aldo Di Carlo, credit Emilio Garcia UPMC

Prof. Aldo Di Carlo, Head of the Centre for Hybrid and Organic Solar Energy (CHOSE) at the University of Rome "Tor Vergata" started the session. Prof. Aldo Di Carlo first explained the basic principles of hybrid perovskite solar cells and the related engineering fabrication process. He then focused on stability stress tests that are carried out at CHOSE and presented results showing that proper sealing strategies can improve their stability and lifetime under Thermal and Damp-Heat tests.

Following Prof. Di Carlo talk, Dr. Rüdiger Berger, group leader at Physics at Interfaces, Max Planck Institute for Polymer Research in Mainz, presented how local probes such as Scanning Force Microscopy (SFM), conductivity Force Microscopy (c-SFM) and Kelvin Probe Force Microscopy (KPFM) techniques can be used to probe the electrical properties of organic thin films. Dr. Berger then



Rüdiger Berger, credit E. Garcia UPMC

detailed the powerful KPFM technique that is used to quantify the changes in the work function on organic and hybrid perovskite films, which is of great importance in the development of devices.



Shahzada Ahmad, credit E. Garcia UPMC

The perovskite session continued with Dr. Shahzada Ahmad, investigator at Abengoa Research (Seville Spain), a Spanish company that develops hybrid perovskite solar cells. He presented how the efficiency of perovskite evolves with time and he showed that a fast decrease is indeed observed soon after the engineering of the cell.

Prof. Jacky Even, Head of the OHM/Simulation research group in the laboratory Fonctions Optiques pour les Technologies de l'informatiON (FOTON) in Rennes, reported on experimental/numerical

simulations studies of photo-degradation in perovskite materials and solar cells. Microstructure and grain boundaries play a significant role in the degradation mechanisms.



Jacky Even, credit E. Garcia UPMC



Bertrand Philippe, credit E. Garcia UPMC

The perovskite session ended with a talk from Dr. Bertrand

Philippe, Uppsala University, where it was explained how photoemission provides an overall picture of the electronic structure of perovskites and its relation to the scaffold layer. The early afternoon was devoted to informal discussions around the posters presented by the participants. Finally, Dr. Roger Hiorns, CNRS researcher at Institut des sciences analytiques et de physico-chimie pour l'environnement et les matériaux in Pau, presented a general overview of the structure of and results from the European ITN "Ensuring stability in organic solar cells" (ESTABLIS) Project. One major output of the ITN is an on-going project that involves a group of small villages around Pau that are installing organic solar cells on cultural heritage monuments such as churches or ancient buildings.

Finally Prof. Nadine Witkowski from the Pierre and Marie Curie University gave concluding remarks. Because one of the major drawbacks in the development of organic solar cells relies in their limited lifetime and stability, various strategies to overcome these difficulties were presented in a very friendly atmosphere during these two days in Paris. Tuning the structural properties, including additive molecules or encapsulating the active layers, are few of the tracks that are under investigation to improve the reliability of organic devices. Abstracts of talks and posters presented during the workshop are available here (<http://thinfacew2016.sciencesconf.org/program>), video interviews of experts in the field will be published soon on the THINFACE website as well.