ESONN'2020 European School On Nanosciences and Nanotechnologies

Virtual practicals & on-line tutorials

N°65:
Fabrication and characterisation of a hybrid perovskite solar cell.

Teachers:
Dmitry Aldakov and Jiajiu Ye, IRIG/SyMMES-CEA, UGA and CNRS.

The photovoltaic technology based on hybrid perovskite materials as light absorbers has emerged recently and extremely rapidly overpassed the silicon one in terms of both efficiency and cost and keeps developing. In other words, it conceals a huge potential for the efficient large scale integration. The efficiency of solar cells using thin films of metalorganic Pb-containing perovskites as light absorbers has achieved 25.2% in just few years, which makes them perfectly on par with well-known thin-film technologies. An important advantage of commonly used hybrid methylammonium lead(II) trihalide $MAPbI_3$ perovskite materials is their extremely high charge mobility, which allows to increase the perovskite film thickness to absorb a maximum of light and possibility to fabricate all-solid state cells.

The sudden emergence of perovskite solar cells and their facile solution-based fabrication method offer a unique opportunity to give a hands-on experience in mainstream photovoltaics. The lab training proposes to perform the complete cycle of fabrication of perovskite cells starting from wet materials deposition all the way to their characterization. After a short introduction, we will show a video starting with mesoporous TiO2 deposition on FTO, then the perovskite solution deposition by spin-coating on TiO2, annealing of polycrystalline perovskite. The cell will be completed by the deposition from solution of a classical doped hole-transporting material, spiro-OMeTAD, and finally gold electrodes evaporated on top using a specially designed mask. Even though the perovskite materials are relatively robust and stable against the structural defects, they are sensitive to the ambient humidity, so most of the deposition work will be performed in a glovebox. At the end of training the efficiency of the obtained cells will be measured using solar simulator. Current efficiency record in our lab is 21%. After the demonstration of these steps, we will discuss the details and outcomes of this process.

Profile: Students interested by new technologies for renewable energies with chemistry and materials science background.