SEMINAIRE ISMO

Philip Schulz

CNRS, Institut Photovoltaïque d'Île de France (IPVF), Palaiseau

Interfaces in Halide Perovskite Semiconductors

In the past decade, halide perovskite (HaP)-based solar cells (PSC) demonstrated a remarkable breakthrough in photovoltaic performance with power conversion efficiencies exceeding 25%. HaPs mark an outstanding class of materials for photon absorption but are prone to degradation due to their hybrid organic inorganic character and hence volatile chemical components and reactive halide ions. While HaPs exhibit a pronounced defect tolerance and self-healing such that the electronic properties do not change considerably with the formation of defects, film degradation will eventually deteriorate the optoelectronic properties. A key strategy to substantially enhance the stability of these compounds is to modify the interfaces and thereby control the chemistry and driving force for ion migration in the perovskite film. My talk will focus on the means and developments to analyze and tailor interfaces in HaP based semiconductor devices to gain control over the electronic properties at the nanoscale and electronic coupling to adjacent functional layers. I will further highlight the use of photoemission spectroscopy to determine the surface energetics and electronic energy level alignment at the HaP/CTL interface while at the same time tracking the interface chemistry. This approach, complemented by optical spectroscopy and mass spectrometry techniques, enables us to evaluate band offsets in the layer system in face of chemical interactions and changes in the electrostatic potential at the interfaces. The results not only suggest guidelines on how to integrate CTLs into PSCs but also explain more generally to what extent the electronic structure of the perovskite is subject to extrinsic perturbations and would ultimately pertain to stability concerns in devices.
I will conclude my talk by further exemplifying how surface treatment and interfacial design routes can be employed to achieve record power conversion efficiencies in HaP-based quantum dot solar cells. Therein, our approach is driven by a targeted ligand exchange chemistry.

Mardi 10 mars 2020 à 11 h

Amphithéâtre du bât 520 (3ème étage)

Université Paris-Sud - 91405 ORSAY Cedex