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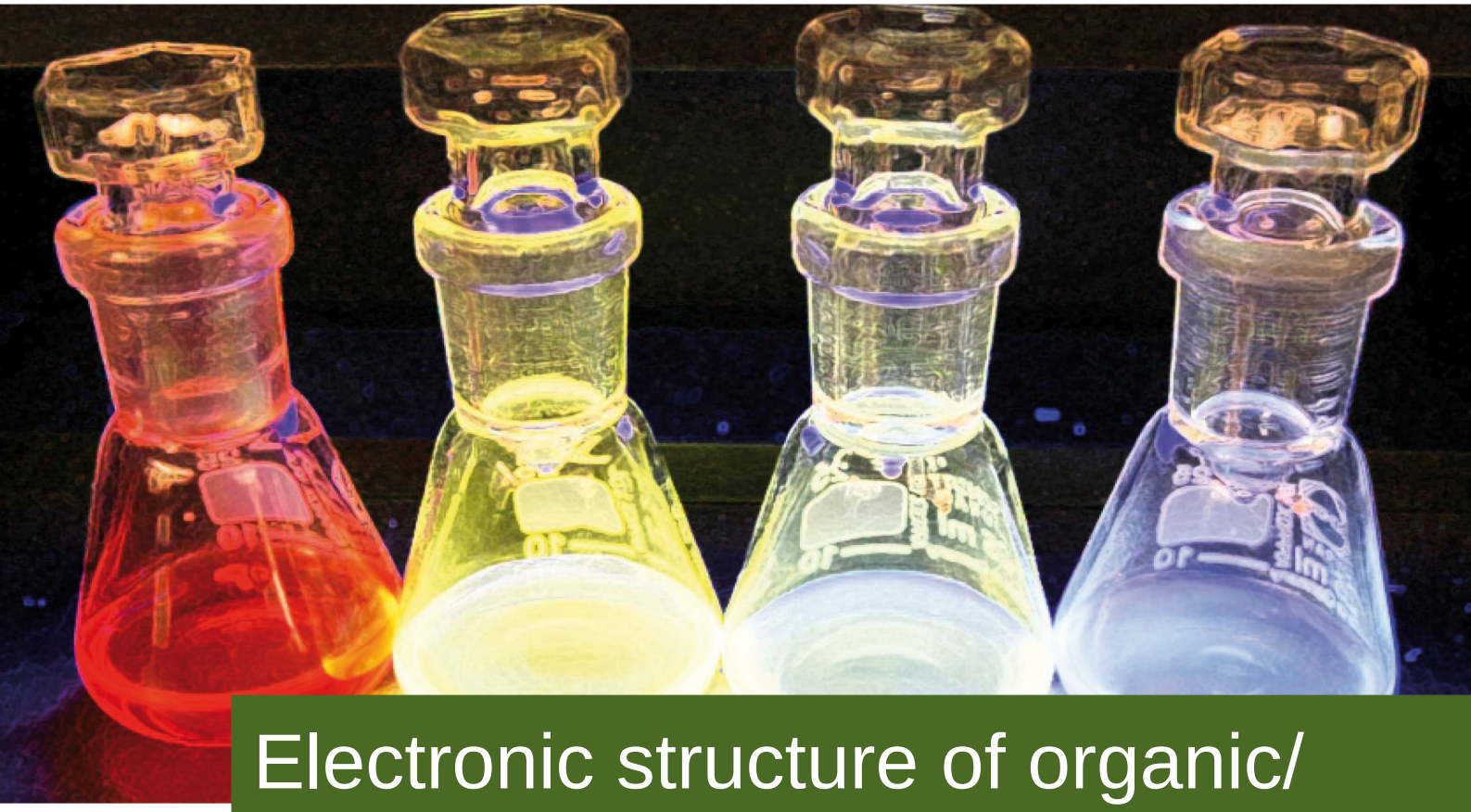

Electronic structure of organic/ oxide interfaces for OPV devices

Prof. Dr. Antoine Kahn
Dept. of
Electrical Engineering,
Princeton University

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FZH 3

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Charge carrier transport across organic/organic and hybrid organic/inorganic interfaces plays a central role in the performance of most organic devices. In organic photovoltaic (OPV) cells in particular, the hole-extracting contact on the donor side of the device typically involves large work function transparent conducting electrodes, which have been the subject of intense scrutiny over the past few years. These include transparent conducting oxides (TCO) such as indium-tin or gallium-doped zinc oxides (ITO, Ga:ZnO) or transition metal oxides (TMO) such as molybdenum, tungsten, vanadium or nickel oxides (MoO_3, WO_3, V_2O_5, NiOx).

This talk examines the formation of some of these films via vacuum evaporation, or via solution or sol-gel deposition. We look at specific interfaces between hole-transport organic materials (HTM), i.e. the donor in an OPV cell, and these TCOs and TMOs, their electronic structure and corresponding hole-injection/extraction efficiency. Simple electrode/organic/electrode "hole-only" devices are fabricated for current-voltage measurements. These comprise an HTM (small molecule or polymer) with the metal oxide as bottom contact and a heavily p-doped layer at the top contact for facile hole-injection. Hole injection/extraction from/to TCOs and TMOs are correlated with the interface electronic structure, and compared with performance achieved with standard ITO and PEDOT:PSS electrodes. Results from "electron only" devices comprised of electron transport materials, TCO and TMO layers are presented and discussed from the view point of the material's electron-blocking properties. Results are presented on both standard-geometry and inverted OPV cells comprising solution processed NiOx or V_2O_5. Finally, the electronic structure of oxide/oxide or oxide/organic pairs as possible charge (electron-hole) recombination layers for tandem cells is discussed.