Organic Electronics: Characterization of Hybrid Organic–Conducting Oxide Interfaces

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We will first give a brief overview of recent advances in the field of organic electronics and, in particular, organic light-emitting diodes and organic photovoltaics. We will highlight the critical role that hybrid interfaces between organic layers and transparent conducting oxides play in the efficiency of the devices.

We will then discuss the geometric and electronic structures of hybrid interfaces between indium tin oxide (ITO) or zinc oxide and organic self-assembled monolayers (SAMs), in order to clarify the mechanism by which the SAMs are able to modify strongly the conducting oxide workfunction. Taking the example of zinc oxide interacting with organic acceptors such as perylenediimides or fullerenes, we will also describe the role that surface defects (such as vacancies or interstitials) play in determining the magnitude and sign of the charge transfer occurring at the interface. [1-4] Comparison of the computational results with ultra-violet photoelectron spectroscopy data underscores the major influence that defect sites have on the specifics of interfacial interactions and, as a consequence, on charge carrier injection or extraction.

[1] P. Winget *et al*., Advanced Materials 26, 4711 (2014).
[2] M. Gruenewald *et al*., Journal of Physical Chemistry C 119, 4865 (2015).
[3] H. Li and J.L. Bredas, Advanced Materials 28, 3928 (2016).
[4] M. Timple *et al*., Advanced Functional Materials (2017).