# CHARACTERIZATION OF ORGANIC/ORGANIC/SUBSTRATE INTERFACES OF THIN p-n HETEROSTRUCTURES

*E. Andrzejewska[1], J. Álvarez[1], M.J. Capitan[1,2] and R. Miranda[1,3]*
*1 Universidad Autónoma de Madrid, Madrid, Spain*
*2 Consejo Superior de Investigaciones Científicas, Madrid, Spain*
*3 Instituto Madrileño de Estudios Avanzados - Nanociencia, Madrid, Spain*
*ewelina.andrzejewska@uam.es*

The microscopic structure of organic p-n heterojunctions plays a key role in electronic devices built from semiconducting organic molecules. The impact of the morphology and the electronic structure on function, performance and lifetime of organic devices is of the utmost interest, especially for organic light emitting diodes (OLEDs), organic ambipolar transistors or organic solar cells.

We shall describe an in-situ morphological and electronic characterization of thin films of p-type and n-type oligomers, such as pentacene ($C_{22}H_{14}$) and copper-hexadecafluorophthalocyanine ($F_{16}CuPc$) [1] grown on sapphire ($Al_2O_3$) [2], conducting ITO [3] and PEDOT:PSS/ITO [4], [5] substrates under UHV conditions. Using Photoelectron Spcetroscopy (UPS, XPS) and AFM [6], the electronic structure and the morphology of organic/organic and substrate/organic interfaces were determined as a function of thickness of the films and growth conditions.

The geometrical orientation of both type of molecules on the mentioned substrates and the orientation of phthalocyanines on pentacene were analyzed by AFM. With different coverage configuration pentacene/phthalocyanine bi-structure grows with similar morphologies on the mentioned substrates. On a pentacene surface, phthalocyanines nucleate in two kinds of structures: a fibrous one that forms flat surfaces, and a globular one forming columnar stacks. Information on modifications of the relevant LUMO and HOMO levels, the stoichiometry and work function of thin layers and at the substrate/organic/organic interfaces, comes from the core and valence band spectra. Finally we discuss briefly a method to control the self assembly of such bi-layered structures which may have a significant impact for future organic devices.

**References:**

[1] D. G. De Oteyza, E. Barrena, J. O. Osso, Thin Solid Films, **21**, (2008), 7525
[2] K. Itaka, M. Yamashiro, J. Yamaguchi, Applied Surface Science, **252**, (2006), 2562
[3] G. Greczynski, Th. Kugler, W. R. Salaneck, Thin Solid Films**, 354**, (1999), 129
[4] A. W. Denier van der Gon, J. Birgerson, M. Fahlman, Organic Electronics, **3**, (2002), 111
[5] Z. Z. You, Journal of Electron Spectroscopy**, 160**, (2007), 29
[6] R. Naito, S. Toyoshima, T. Ohashi, Japanese Journal of Applied Physics, **2**, (2008), 1416

**Figures:**