Azine Functionalized Oligothiophenes as Semiconductors for OFETs. Molecular Basis of their Electrical Behaviour.

R. Ponce Ortiz[a], *S. Rodríguez González*[a], *J. Casado*[a], *V. Hernández*[a], *J. T. López Navarrete*[a], *J. A. Letizia*[b], *A. Facchetti*[b], *and T. J. Marks*[b]
[a] Department of Physical Chemistry, University of Malaga, Campus de Teatinos s/n, 29071, Málaga, Spain, rocioponce@uma.es. [b] Department of Chemistry, Northwestern University, 2145 Sheridan Road, 60208-3113, Evanston, Illinois, USA, a-facchetti@northwestern.edu.

In this communication, the structural and optical properties of a series of azine functionalized oligothiophenes (Figure 1) have been analysed by means of electronic and vibrational spectroscopies and quantum-chemical calculations. The semiconductor actuation of these new materials have been evaluated in MOS-FET configuration [1]. Additionally, the optical properties have been carefully studied trying to direct their use as lighting materials, lasers and light emitting transistors (OLETs) [2].

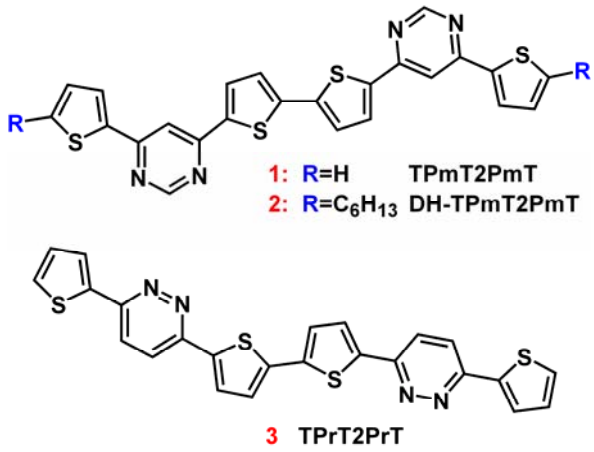

Figure 1.- Chemical structures and abbreviate notation to be used throughout the text.

The characterization of these systems evidences that the molecular properties are controlled by the nature of the central bithiophene, and hence their properties correspond to sizeable π–electron extended bithiophenes. This is particularly surprising in the case of charge mobility since originally these molecules were conceived for electron transport (i.e., azine units behave as electron reductors), however they do behave as hole transporters as expected for the family of neutral aromatic oligothiophenes.
The mobilities recorded for the azine-oligothiophene based devices were rather medium-low, with the highest figures being 4 x 10^{-3} $cm^2V^{-1}s^{-1}$ (threshold voltage (V_T) = -68 V; current on/off ratio ($I_{on/off}$) = 10^7) for TPrT2PrT at T_D = 110 °C. Although these first results are not exceptional, the interest of these systems can result from further chemical modification of the azine synthons, for example with acceptors, which could eventually lead to the inversion of the sign of the majority of charge carriers, leading to chemically/physically compatible p/n heterojunctions.

[1] Facchetti, A.; Mushrush, M.; Katz, H. E.; Marks, T. J. Adv. Mater. 2003, 15, 33.
[2] Forrest, S.R. Nature 2004, 428, 911. Muccini, M. Natur. Mater. 2006, 5, 605.