Organic Materials: The Effect of Subtle Modifications on Device Performance

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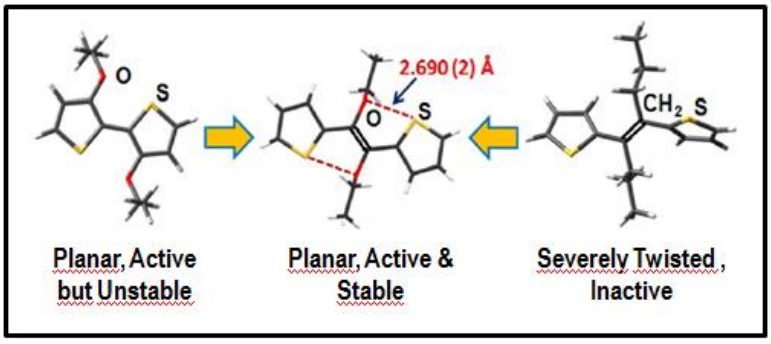
In the search of new high-mobility polymeric semiconductors with good processability and excellent environmental stability, diverse synthetic strategies have been approached. One of the most widely used consists in the alternation of donor and acceptor moieties in the conjugated skeleton, which allows fine tuning of the polymer frontier molecular orbitals. For organic field effect transistors (OFETs) applications, low-lying HOMOs are essential to resist air oxidation and thus increase device stability. However, if the HOMO energy is too low, the resulting barrier to hole injection may compromise the transistor performance. Thus, a delicate balance between these two effects is needed. Furthermore, high performance solution-processable materials require the correct selection and positioning of the specific solubilizing substituents in order to achieve proper HOMO and LUMO energy levels, planar molecular conformations, close intermolecular π-π stacking, and proper thin film crystallinity.

Following these two combined strategies, diverse polymeric materials with great performances in both OFETs and solar cells, and having remarkable air stability, have been synthesized and characterized.[1,2] This contribution will analyze how small modifications in their molecular structures can have a great impact on the device performance.



Scheme 1: An example highlighting the effect of subtle modifications on device performance.

1 (a) Huang, H.; Ponce Ortiz, R.; Chen, Z.; Newman, C.; Usta, H.; Lou, S.; Youn, J., Noh, Y.-Y.; Baeg, K.-J.; Chen, L. X.; Facchetti, A.; Marks, T. J. *J. Am. Chem. Soc.* **2012**, *134*, 10966. (b) Guo, X.; Ponce Ortiz, R.; Zheng, Y.; Gu, Y.; Noh, Y.-Y.; Baeg, K.-J.; Facchetti, A.; Marks, T. J. *J. Am. Chem. Soc.* **2011**, *133*, 1405. (c) Guo, X.; Ponce Ortiz, R.; Zheng, Y.; Kim, M.-G.; Zhang, S.; Gu, Y.; Lu, G.; Facchetti, A.; Marks, T. J. *J. Am. Chem. Soc.* **2011**, *133*, 13685.

2 Guo, X.; Zhou, N.; Lou, S. J.; Smith, J.; Tice, D. B.; Hennek, J. W.; Ponce Ortiz, R.; López Navarrete, J. T.; Li, S.; Strzalka, J.; Chen, L. X.; Chang, R. P. H.; Facchetti, A.; Marks, T. J. *Nature Photonics* **2013**, *7*, 825.