Molecules for organic electronics. Tuning the self-assembly and electronic and properties

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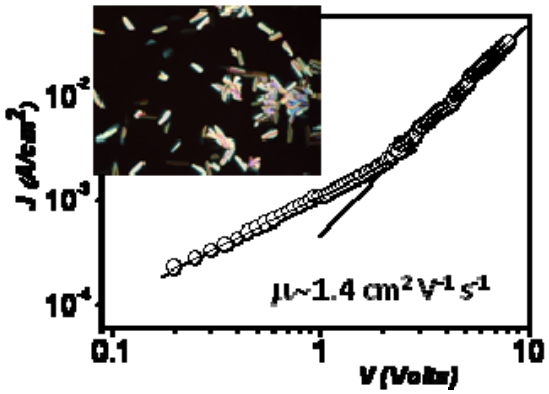
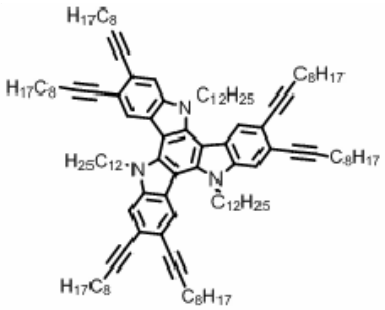
Organic electronics is rapidly developing thanks to the discovery of new molecules able to transport charge carriers efficiently. Organic semiconductors with mobilities able to compete with amorphous silicon have already been obtained, although they have in many cases stability and processability problems. At this stage there is a significant need for new organic semiconducting materials that combine the ability to perform efficient charge transport with good processability and stability properties. In this context we became interested on electron-rich 10,15-dihydro-5*H*-diindolo[3,2-*a*:3',2'-*c*]carbazole (triindole), a new organic semiconductor that can be considered as an extended π-system constituted by three carbazole units that share an aromatic ring. The chemical structure resemblance with the well known hole-transporter carbazole, together with the π-extended disk-like structure, renders triindoles attractive candidates in the search of new organic semiconductors.
In fact the positive synergy between molecular structure (electron rich, extended π--system) and bulk arrangement (highly ordered columnar assemblies, close packing, efficient intermolecular π-orbital overlap) has led to the construction of a novel triindole-based mesogen that exhibits the highest hole-mobility reported to date ($\mu \sim 1.4\ cm^2\ V^{-1}\ s^{-1}$) [1].





In this contribution, we show how through an adequate functionalization we can modulate both the electronic and self-assembling properties of these derivatives [2], [3] . Optimization of their performance and processability towards their incorporation in devices will also be discussed.

[1] García-Frutos, E. M.; Pandey, U. K.; Termine, R.; Omenat, A.; Barberá, J.; Serrano, J. L.; Golemme, A.; Gómez-Lor, B. *Angew.Chem. Int. Ed. Engl.* **2011**, *in press.*
[2] F. Gallego-Gómez, E. M. García-Frutos, José M. Villalvilla, J. A. Quintana, E. Gutiérrez-Puebla, A. Monge, M. A. Díaz-García, B. Gómez-Lor, *Adv. Funct. Mater.* **2011**, *21*, 738.
[3] García-Frutos, E. M.; Gómez-Lor B. *J. Am. Chem. Soc.* **2008**, *190*, 9173.