Electronic Properties of Naphthalimide-based Ladder-type Systems

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The tuneable electronic and structural properties of organic semiconductors together with their flexibility, light weight, high solution processing and low costs in comparison with inorganic semiconductors are some of the key points for the current interest in the development of π-conjugated small molecules and polymers for a variety of applications. In this project, a combined experimental and theoretical study of two ladder-type compounds functionalized with naphthalimides[1] (Figure 1) is performed with the aim to explore the impact of the structure on the optical and charge-transport properties. Compound **NDI-TP-Ph-TP** has an imidazole group as a spacer ring and **NIP-TP-Ph-TP** has a spacer ring of pyrazine type. The two molecular systems have been implemented in organic field effect transistors[2] (OFETs), to assess their potential as active materials in organic electronics. Both compounds show p-type mobility, moreover, **NDI-TP-Ph-TP** material also displays low n-type mobility, presenting a certain ambipolar character.

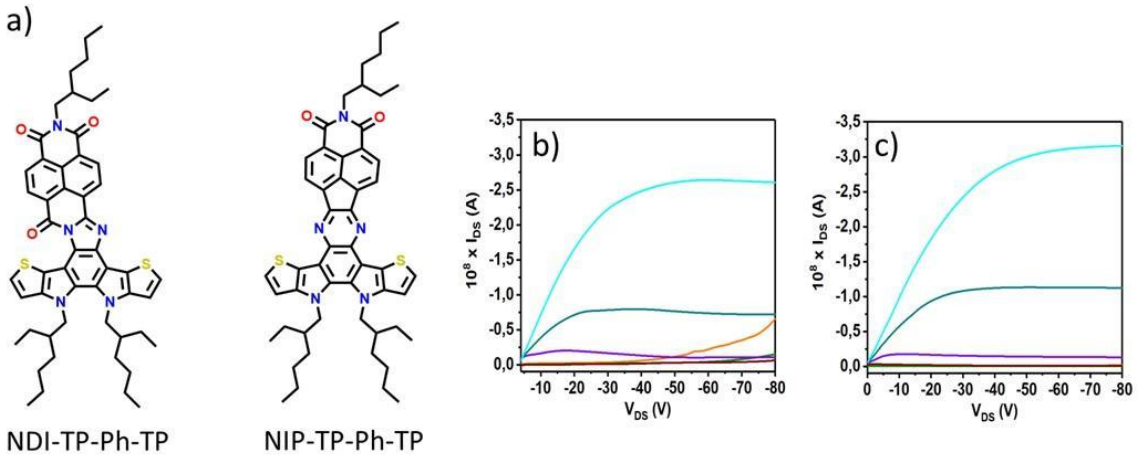

Figure 1. a) Chemical structures of the studied ladder-type systems, b) and c) OFET output curves for **NDI-TP-Ph-TP** and **NIP-TP-Ph-TP** respectively (V_{GS} ranges from 0 to 80 V in steps of 10V)

References

1. Alonso-Navarro, M. J. et al. Effective interplay of donor and acceptor groups for tuning optoelectronic properties in oligothiophene–naphthalimide assemblies. J. Mater. Chem. C 8, 15277–15289 (2020).

2. Ortiz, R. P. et al. Organic n-Channel Field-Effect Transistors Based on Arylenediimide-Thiophene Derivatives. J. Am. Chem. Soc. 132, 8440–8452 (2010).