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Synthesis, characterization, photovoltaic performances and stability analysis of new NFA molecules with an extended pi-conjugated core

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In the past few decades Organic Solar Cells (OSC) have emerged as one of the promising third generation photovoltaic technology on account of their advantages like light-weight, flexibility, transparency and potential low cost[1]. Until 2012, the scientific community has made considerable efforts on the development of new donor materials combined with fullerenes. Despite the development of hundreds of new p-type materials, the efficiency of OSC have not become potentially competitive until the rise of non-fullerenes acceptors, which have overcome some of the technical drawbacks associated to the fullerenes. Using them, the photovoltaic performance have been increased up to 16%[2] in single junction and over 17%[3] in tandem solar cells. Although, it must be remembered not only a high efficiency is required but high stability to make OSC technology viable for commercialization. Thus, more in-depth study are needed to further understand degradation mechanisms.

In that context, we present the synthesis, the characterization and the use in OSCs of three new NFAs with extended π-conjugated segments between the acceptor moieties. Some of them contain fluorine atoms in the acceptor units, which has been proved to play a role on the photovoltaic performance[4]. These NFAs have been combined with the PCE12 donor polymer obtaining, as preliminary results, power conversion efficiency comprise 5-6% with an outstanding V_{oc} over 1,1V, significantly higher compared with ITIC-based devices used as a reference in this work. The NFAs have been exposed under thermal and photochemical stress. Noticeably, one of the, exhibited improved stability compared with ITIC.

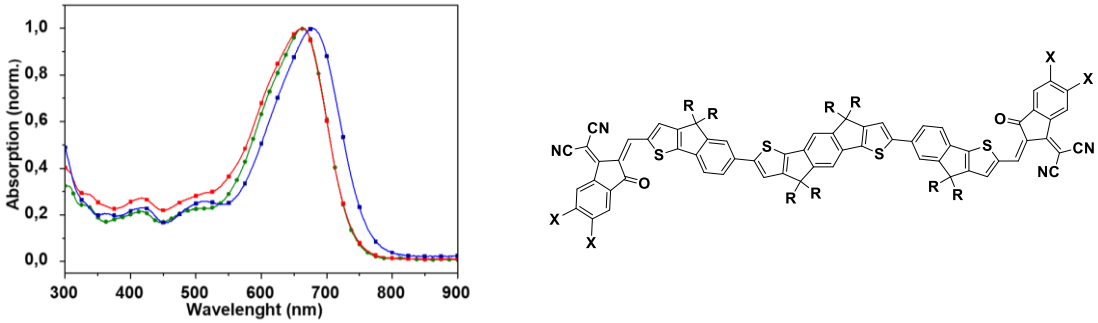

***Figure 1**: Normalized absorption spectra of the new NFAs (left) and structure of the new NFAs (right)*

[1]: Inganäs, O. Adv. Mater. 30, 1800388, (2018).
[2]: Y. Cui *et al.*, Nat. *Commun.* 10, 2515, (2019).
[3]: L. Meng *et al.*, Science, vol. 361, 1094, (2018).
[4]: T. J. Aldrich *et al.*, J. Am. Chem. Soc, vol. 141, 3274, 2019.