P13

p-Type Fluorene-Based Organic Semiconductors for Efficient Perovskite Solar Cells

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Solid-state organic hole transporting materials (HTMs) are one of the important components of the perovskite solar cells (PSCs). Spiro-OMeTAD is the most popular choice for the HTM layer, and is used for the majority of the state-of-the-art PSC devices. However, it is not only quite expensive but also shows unsatisfactory longterm stability due to oxidative doping process and slow morphological degradation [1].

In this work, novel small-molecule HTMs were synthesized in three-step synthetic route, starting from simple fluorene derivatives (Fig.1).

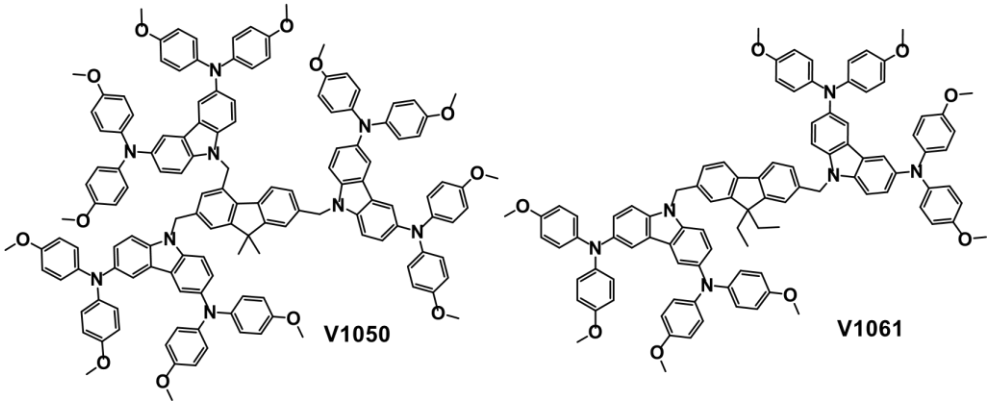

Figure 1. Structures of fluorene-based HTMs **V1050** and **V1061**.

PSCs of planar configuration, employing **V1050** HTM showed a high power conversion efficiency of 18.3%, which is comparable to the 18.9% efficiency, obtained in the same device configuration, only using Spiro-OMeTAD as a HTM. In addition, devices with **V1050** and **V1061** showed better stability in comparison to Spiro-OMeTAD based devices. Aging test was performed on a non-encapsulated devices under uncontrolled humidity conditions (relative humidity around 60%) in the dark and under continuous full sun illumination. Overall, we believe that the **V1050** can be a usefull alternative HTM to Spiro-OMeTAD for perovskite solar cells, thus bringing PSCs closer to commercial production.

REFERENCES

[1] Z. Li, Z. Zhu, C. C. Chueh et al., Facile Thiol-Ene Thermal Crosslinking Reaction Facilitated Hole-Transporting Layer for Highly Efficient and Stable Perovskite Solar Cells, Adv. Energy Mater. **1601165** (2016).