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## Study of different hole transporting materials for hybrid perovskite solar cells

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Over the last years, interest for organolead trihalide perovskite materials ( $ABX_3$  where A is an ammonium cation, B a metal cation and X an halide) as light absorber in solar cells has increased continuously<sup>[1]</sup>. One of the most studied hybrid perovskite material is methylammonium lead triiodide ( $MAPbI_3$ ) leading to 15 to 20% efficiencies in a FTO/ $TiO_2$ /mp- $TiO_2$ /MAPbI<sub>3</sub>/Au structure<sup>[2,3]</sup>.

A new method for preparation and one-step process deposition of the perovskite material<sup>[4]</sup> is here used in a planar heterojunction FTO/compact- $TiO_2$ /MAPbI<sub>3</sub>/HTM/Au structure leading to 11% efficiency (on 0.28 cm<sup>2</sup> cell) when Spiro-MeOTAD is used as HTM (J/V curve Figure 1 (left)). Five new spiro-based HTM (Figure 1 (right)) are then compared to this reference system.

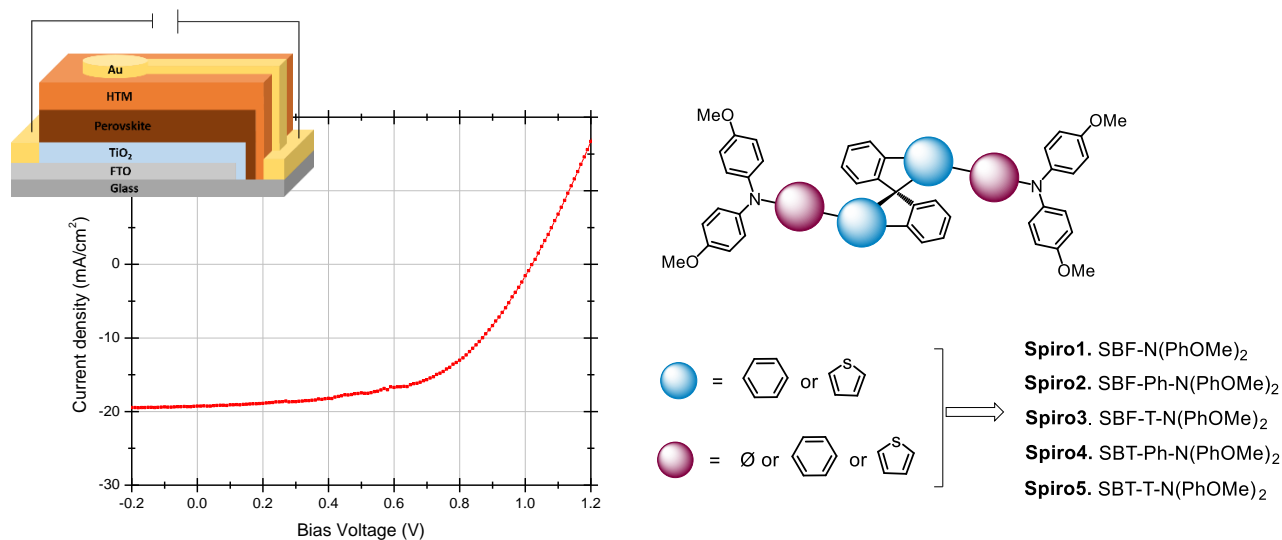


Figure 1. General cell architecture and J/V curve when Spiro-MeOTAD is used as HTM in this structure (left) and Structures of the five new HTM (right)

<sup>1</sup> Jung, H. S. and N. G. Park (2015). "Perovskite solar cells: from materials to devices." *Small* 11(1): 10-25

<sup>2</sup> Burschka, J., et al. (2013). "Sequential deposition as a route to high-performance perovskite-sensitized solar cells." *Nature* 499(7458): 316-319

<sup>3</sup> Gao, P., et al. (2016). "A molecularly engineered hole-transporting material for efficient perovskite solar cells." *Nature energy*.

<sup>4</sup> Jeon, N. J., et al. (2014). "Solvent engineering for high-performance inorganic-organic hybrid perovskite solar cells." *Nature Materials* 13(9): 897-903