STABILITY INVESTIGATION OF OXIDIZED spiro-MeOTAD

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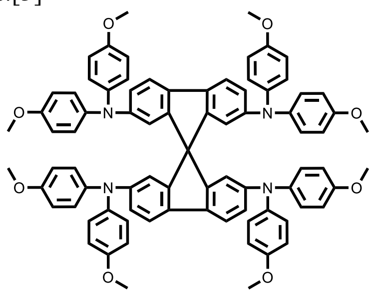
Population growth and ever-increasing energy consumption prompts new search for cleaner and safer alternatives to fossil fuels and nuclear energy. One of the most attractive alternatives is photovoltaic systems. Because of simple manufacturing and good performance prospects perovskite solar cells received growing interest from research community. As a result of rapid development in this field, perovskite photovoltaic systems have reached 23.7% [1] efficiency.

Charge-transporting materials has been developed for use in perovskite solar cells and vast majority of them require the use of chemical doping as an essential step for preparation of efficient devices.[2] Oxidized 2,2´,7,7´-tetrakis(N,N-di-p-methoxyphenylamine)-9-9´-spirobifluorene (Spiro-MeOTAD) could be one of the potential weak links in the perovskite solar cell composition. Interestingly, very little investigation is done concerning the oxidized HTMs applied in the PSC and their properties.[3]



Spiro-MeO-TAD

Despite relatively high performance of perovskite solar cells, there is still a long list of things to do before requirements for commercialization are met. One of them is long term stability of the devices. Lead halide perovskite itself is moisture sensitive material and degrades rapidly when exposed to the ambient conditions. This problem is well-known and considerable amount of research is dedicated towards solving or mitigating it. Another possible weak link is dopant-containing hole transporting materials, containing considerable amounts of oxidized HTM.

In this work hole-transporting material spiro-MeOTAD, has been investigated under various conditions in order to estimate overall lifetime and influence of different additives. Interestingly, that a significant number of samples containing films of oxidized spiro-MeOTAD, started to crystallize at elevated temperatures. It is known that oxidized HTM, formed during doping, is responsible for the increased conductivity and ultimately for better efficiency of hole extraction process in the PSC device; therefore, observed instability of the oxidized HTMs in the thin films at elevated temperatures could be one of the causes of drop in conductivity reported for the doped spiro-MeOTAD. It could also potentially be one of the reasons why perovskite solar cells lose their efficiency under prolonged thermal stress. Possible solution to this problem could be use of HTMs that do not require doping and therefore do not rely on oxidized materials to improve conductivity. Development of the efficient technique to regenerate oxidized species in situ in the functioning device could be another albeit more complicated alternative

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